THE ARCHAEOLOGY OF THE UPPER PLYM VALLEY

JENNIFER G. ROBERTSON

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This thesis is submitted to the Faculty of Arts, University of Edinburgh in fulfillment of the requirements of the degree of Doctor of Philosophy and I declare that this thesis is entirely my own composition.

Jennifer G. Robertson

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All the photographs in this thesis are by the author, apart from Plate 4:3 of Legis Tor warren, which was kindly supplied by the Cambridge University Collection of Air Photographs (C.U.C.A.P.) and Plate 4:15 of rabbit nets, which was kindly supplied by the Lisburn Museum.

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ABSTRACT

The Upper Plym Valley, Dartmoor, containing an exceptional range and number of field monuments, has already attracted considerable attention from archaeologists and antiquarians. However, previous studies have tended to focus on a single aspect of land use. Thus, the total landscape survey, commissioned in 1982 by English Heritage, and executed by Edinburgh Archaeological Services under the direction of Mr. Roger Mercer, of an area of 25km^2, provided the first opportunity to assess the relationships between remains of different periods and between those of contemporary but different types of land use. The survey provided the database for this thesis and maps of the whole area and descriptions of nearly 2000 monuments have been compiled as Appendices.

Analysis of the field evidence is divided into four parts. Discussion of the prehistoric monuments concentrates on the variations in size and structure of the settlement remains, aided by large-scale plans of over 400 hut-circles. The contrast between seasonal and permanent occupation and the relationship between the settlements and the ceremonial and burial sites are considered.

The development of medieval agricultural settlement is traced through field remains and documentary sources. Evidence was found of 13th century colonization and 14th century desertion, a pattern repeated elsewhere on Dartmoor, but at least three farms survived into the Post-Medieval period and use of the valley for pasture may be pushed further back, at least to Domesday.

Two major Dartmoor industries are also discussed: rabbit-warrening, which was practised from the 17th to the 20th centuries, and tin-working, documented in the valley from the 16th century but possibly originating in the Bronze Age. The field evidence for both is examined and interpreted with the aid of contemporary accounts and comparison with other sites.

Finally the evidence for links between contemporary activities, particularly tin-working and agriculture, is examined and the main conclusion to be drawn is that this tract of "marginal" land has been a much more valuable and widely-used resource than might at first appear.

CHAPTER 1: INTRODUCTION

1.1 PREVIOUS WORK IN THE UPPER PLYM VALLEY

The area under consideration in the upper part of the Plym Valley, SW Dartmoor, contains an abundance of field monuments, still visible on the surface. Stone rows and stone circles, cists and cairns, reaves, enclosures and hut-circles, longhouses and associated field systems, rabbit warrens and tinworks stand witness to the long and varied sequence of occupation and land use in the valley.

It is not surprising therefore that this fossilized landscape has long been a subject for study. In the late 19th century, the Upper Plym valley attracted the attention of local antiquarians and in 1895-6, eleven hut-circles in the western Legis Tor settlement, **Mons 211, 223a, 224c, 226e, 226f, 226h, 226i, 226n, 227b, 227d** and **239**, were excavated by the Dartmoor Exploration Committee of the Devonshire Association. (Baring-Gould *et al* 1896, 183-9)

The Barrow Committee of the same Association excavated nine cists in the valley, **Mons 311** and **312** at Legis Lake (Worth 1910, 63; 1912, 83), **Mon 599** at Legis Tor (Worth 1901, 118-9), **Mon 1067** at Drizzlecombe (Worth 1915, 131), **Mons 1172b** and **c** at Deadman's Bottom with two adjacent ring cairns, **Mons 1172a** and **d** (Worth 1900, 50-3), **Mon 1176** at Calves Lake (Worth 1900, 53-5), and two others recorded by Grinsell, Nos. Shaugh Prior 1a and 29 (Worth 1906, 119-120; Grinsell 1978, 162-4), as well as a cairn with a retaining circle at Drizzlecombe (Worth, 1915, 131-3; Grinsell 1978 Sheepstor 23) and a stone circle, **Mon 266** at Brisworthy (Worth 1916, 99-100).

Descriptions and plans of many other prehistoric monuments in the Upper Plym Valley were published by the Devonshire Association, notably six stone rows, with associated stone circles or cairns with retaining circles, **Mons 42** and **48** at Trowlesworthy, **Mon 274** on Ringmoor Down and **Mons 1011, 1025** and **1026** at Drizzlecombe (R.H. Worth 1946, 291-4; R.N. Worth 1892, 400-1; 1895, 440-1), the cairn, interpreted as a "hut cluster", **Mon 472**, below the Cholwich Town reave (R.N. Worth 1890, 237-9), a possible stone circle, **Mon 572**, at Willings Walls (R.H. Worth 1942, 207-10), and at least 24 cists and cairns. (FN 1) (Worth 1890, 307-8; 1900, 48-50; 1901, 119-121; 1929, 85; 1931, 81-2; 1932, 115-117; 1933, 83-5; 1934, 39-40; 1940, 63-4; 1944, 39) Survey and excavation were accompanied by some reconstruction. The Drizzlecombe menhirs, in the stone rows, **Mons 1011a, 1025a** and **1026a**, were re-erected in 1893 (R.N. Worth 1893, 545-6) and the Brisworthy Stone Circle, **Mon 266**, was restored in 1909. (R.H. Worth, 1916, 99-100) Such efforts were not always a positive contribution; the retaining circle, **Mon 274a** was described after reconstruction as "no prehistoric monument, but a self-memorial reared by unrestrained enthusiasm". (Worth 1941b, 235)

The Upper Plym valley has also been central to more recent programmes of fieldwork on Dartmoor. The reaves were pivotal in the rediscovery of the antiquity of reaves and were surveyed and described by Fleming and Collis (1973; Fleming 1978). The cists and cairns were included in Grinsell's survey of Dartmoor barrows (1978) and the prehistoric settlement remains were the subject of a series of papers by Price (1977, 1979, 1982). Excavations on Shaugh Moor to the SW of the present survey area were accompanied by a survey by the Central Excavation Unit of the prehistoric monuments in the upper part of the valley, analysed by Smith. (CEU Survey, Smith, 1982) The prehistoric remains were also the subject of a survey by O'Neill, designed to ascertain the permanence or seasonality of occupation in the Bronze Age. (O'Neill, 1983)

The post-prehistoric remains have also received some attention. The Medieval settlements were discussed by Linehan (1966) and by Price (1980) and the rabbit warrens were mapped and described by Haynes (Maps, MS). Tin streamworks in the Upper Plym valley were recorded by Greeves (1981) in a survey of early tin works over the whole of Dartmoor and a history of Eylesbarrow Mine, with a discussion of its associated monuments, was produced by Cook, Greeves and Kilvington (1974).

Finally UPV has also been the subject of environmental investigations and pollen samples have been analysed from Shell Top

FN 1 Mons. 272, 544, 545, 571, 573, 668, 708, 721, 1009, 1023, 1030, 1073, 1074, 1076, 1083, 1162, 1168, 1169, 1170 and five recorded by Grinsell (Nos. Shaugh Prior 1, 26, 27, 28 and 30). (1978, 162-4)

(Jones 1973), from Whittenknowles (Staines 1979) and from Trowlesworthy and just outside the area to the SW of Blacka Brook (Beckett 1981).

1.2 RESEARCH OBJECTIVES

However all these studies focussed on one particular type or period of land use and it may be argued that only a study of the whole assemblage will enable all the monuments of each type or period to be isolated and interpreted, the relationships between each type or period to be understood and ultimately the full sequence of occupation in the valley to be traced.

Thus morphological comparisons as well as stratigraphic relationships within the whole assemblage may help to assign an individual monument to a particular period or activity and the full range of monuments within the valley associated with a particular period or activity may be identified. More importantly it is only by examination of the total assemblage that the effects of later land use on earlier monuments and the influence of the latter on the former can be fully appreciated. Thus :

> "the distribution and morphology of later monuments within one environment will reflect ultimately upon the known distribution and morphology of earlier examples (and vice versa), as well as providing a template against which the absence or presence of these earlier or later equivalents can be assessed". (Mercer 1985, 11)

Furthermore practices identified in one period can explain the field remains of another. For example, prehistoric settlement evidence may be interpreted in the light of the farming practice identified in the field and documentary evidence of the Medieval period.

As well as these chronological relationships, total landscape survey can also indicate relationships between contemporary activities. The debate over the relationship between the miner and the agricultural community, initiated by Blanchard (1972, 1974) and Hatcher (1974) has recently received a fresh impetus with the publication of excavations and survey in St. Neot Parish, Bodmin Moor. (Austin *et al* 1989) Thus, although the legal, social and economic framework of the tin industry may justify the frequently expressed view of the tinner operating in isolation, it is important to note that:

> "the activities of tinners took place in a shared upland environment full of other important resources, such as timber, brushwood, peat, grazing, hay, bed-straw, wild fruits and small game. ... and tinners, however specialised, should not be regarded as working alone, unseen and divorced from their human and ecological landscape".
> (Austin *et al* 1989, 20-21)

The examination of tinworking remains at Colliford in the context of their agricultural community pointed the way forward in this debate (*op. cit.*) Therefore total landscape survey in the Upper Plym Valley, where tinworking is documented from the 16th century but has probably much earlier origins and where Medieval agricultural settlement is documented from the early 13th century, may further illuminate the relationship between these two activities.

Finally concentration on specific phases of occupation or economic activities may lead to the conclusion that the sequence of land use in the valley consists of a series of separate unrelated episodes. Total landscape survey may therefore be an effective means of tracing the full sequence and an attempt can be made to fill in the gaps, notably between the Bronze Age and the first documented post-prehistoric settlement in the area in the 13th century, as well as explain any changes, such as the transfer from farming to warrening in the 17th century.

1.3 THE UPPER PLYM VALLEY SURVEY, 1982 - 1986

The survey undertaken between 1982 and 1986 by a team, including the present writer, from the Archaeology Department of the University of Edinburgh, directed by Roger Mercer, provided an excellent opportunity to examine the total assemblage of monuments in the Upper Plym valley. Commissioned by the Historic Buildings and Monuments Commission (now English Heritage) to provide a gazetteer of monuments in the area owned by the National Trust and then in guardianship, the survey team followed the methods already developed and described by Mercer. (1980, 1-8; 1981,1-3; 1985, 13-15) An area of 25 kms^2 was surveyed by theodolite and plotted at a scale of 1:1000. (See Fig. 1:1) Nearly 2000 individual monuments within this area were identified, mapped and described and about 550 structures were drawn at a larger scale, mostly at 1:50 but some at 1:100 and 1:200.

Additional problem-oriented fieldwork was carried out by the author between 1986 and 1990. Aerial photographs from RAF sorties and in the RCHME collection were examined, as well as a plot of aerial photographs of the Plym valley, kindly supplied by RCHME, and documentary sources in the West Devon Record Office, Plymouth and the Devon Record Office, Exeter were consulted in an effort to trace, as fully as possible, the sequence of land use in the valley.

The survey area was to a large extent, dictated by the National Trust area, which covers the S bank of the R. Plym, from Plym Head to Blacka Brook, above the Lee Moor China Clay Works Leat, **Mon 47** and excluding the enclosures immediately surrounding Trowlesworthy Warren House, **Mons 130 a-o, 163** and **183**. (See Fig. 1:2) However, the area was extended to cover the N bank of the R. Plym, on the grounds that monuments on one side of a valley will only be clearly understood in the context of the valley as a whole, and that monuments on the N bank are, of course, highly visible to a visitor on the S bank (Roger Mercer pers. comm.).

The SE boundary, through Broad Rock and Shell Top more or less corresponds to the watershed between the Plym valley and the Erme and Yealm Valleys. However the NW boundary was drawn beyond the watershed to include the Eylesbarrow reave, **Mon 271** and the whole of Ringmoor Down so that the boundary corresponds to the moorland / enclosed field interface. The SW boundary is marked by the SW limit of the National Trust area (Blacka Brook) and its corresponding area on the north bank. Here the boundary was again drawn along the moorland / enclosed field interface along Legis Lake and the southern edge of the Ringmoor Down. The survey area is termed UPV, partly for brevity and partly to distinguish it from any wider area of the Upper Plym valley.

It could be argued that the Upper Plym Valley, or moorland Plym, should extend, as Worth defined it, down to Shaugh Bridge. (1889-90, 290)

UPPER PLYM VALLEY
Archaeological Field Survey 1982 - 86
Location Map

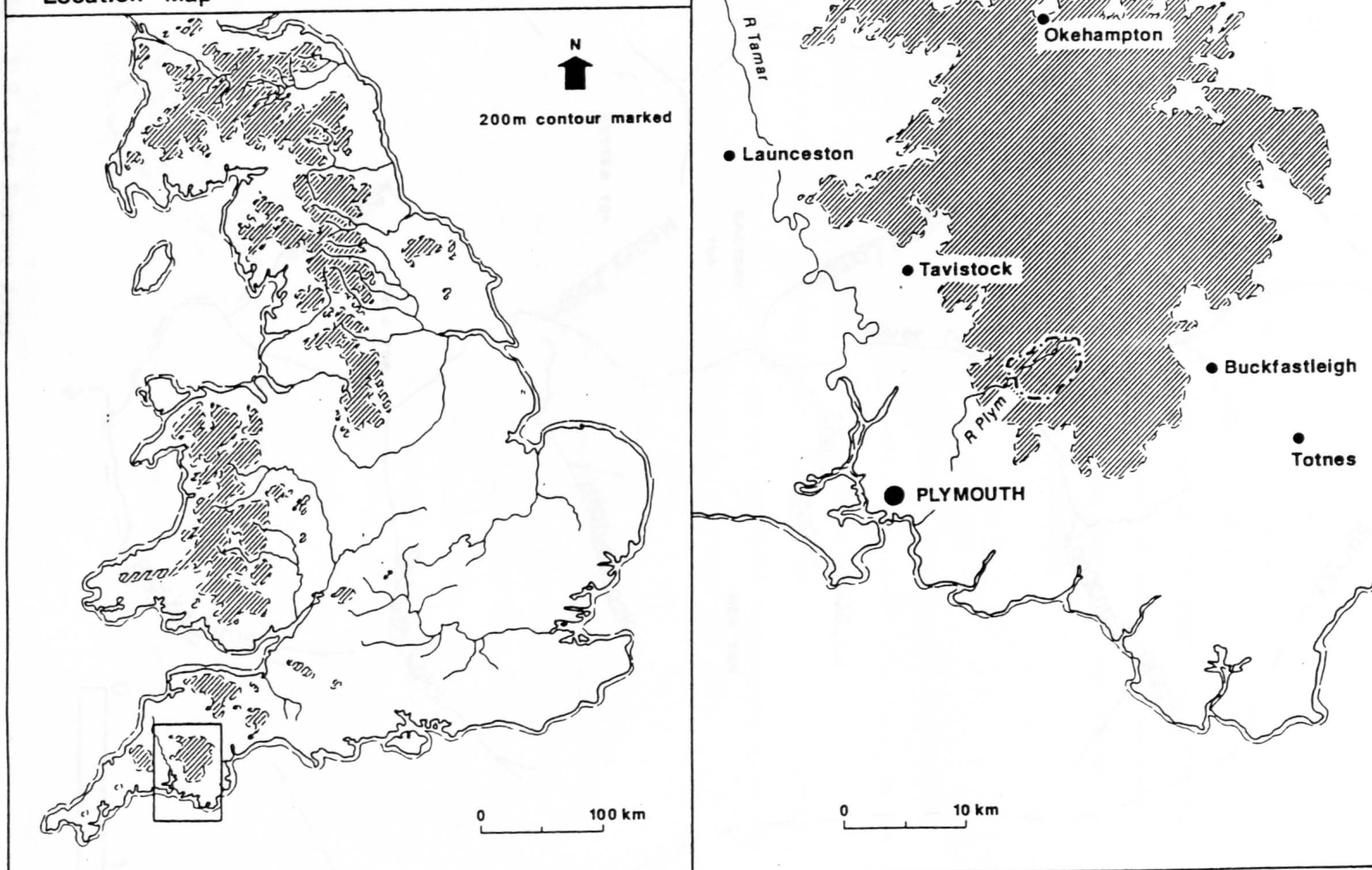


Fig. 1:1

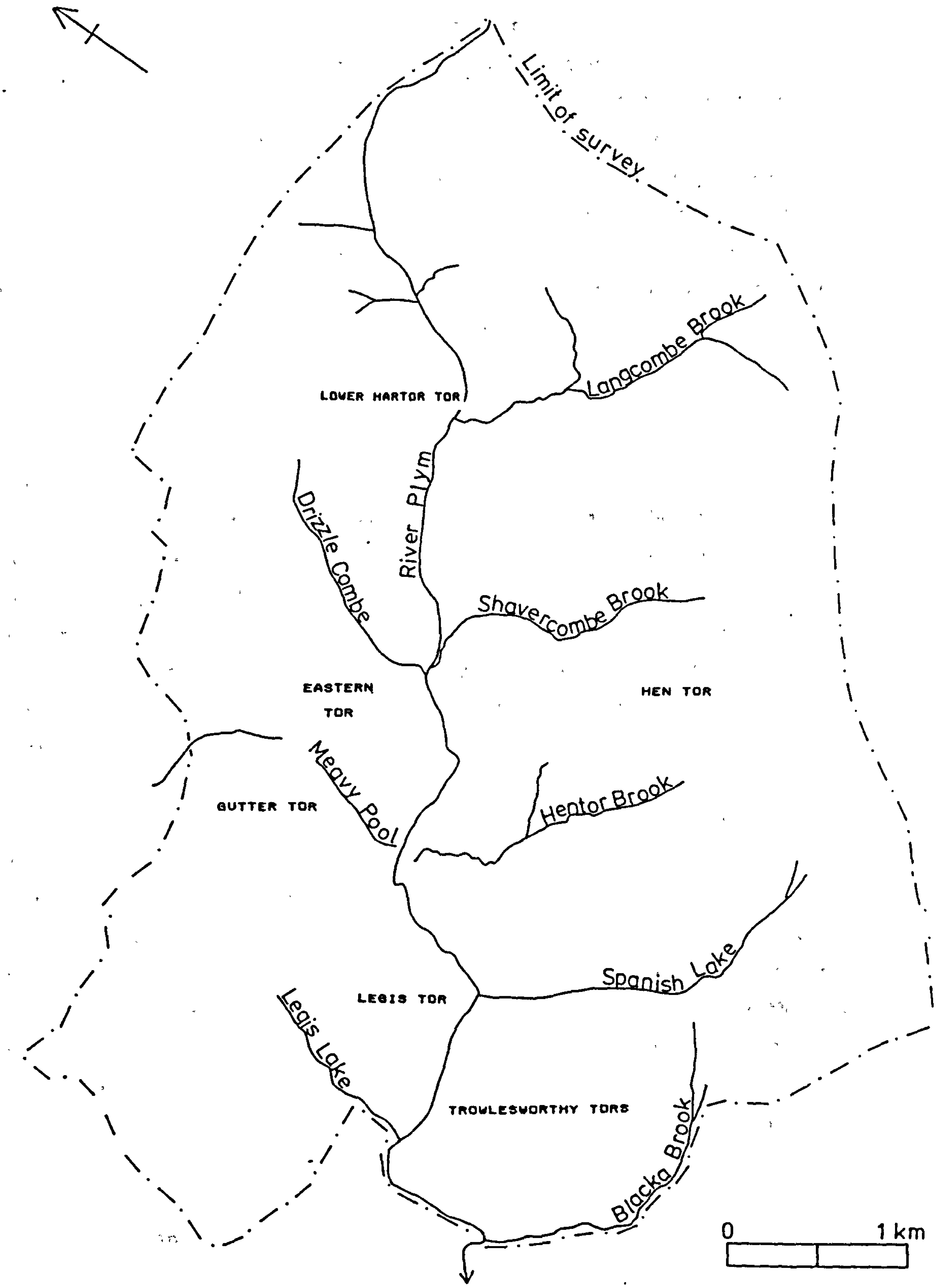


Fig. 1:2 The Survey Area

Certainly an area encompassing the upland "territory" between Eylesbarrow and Rook Reaves, down to Saddlesborough terminal reave might be more appropriate for a study of the prehistoric moorland Plym. However much of the area between Blacka Brook and Saddlesborough is now occupied by the Shaugh Lake China Clay Works, and any attempt at continuous map coverage is necessarily restricted to the area E of Blacka Brook. Similarly, by extension of the area on the N bank, only as far as Cadover Bridge, the survey would have included the full range of early tinwork remains by the addition of Brisworthy blowing mill, and a wider range of Medieval agricultural activity by the addition of the Domesday farm at Brisworthy. However this would have encroached on presently occupied farmland at Brisworthy and the survey area was therefore restricted to open moorland to the E and N of the enclosed fields.

1.4 THE THESIS

The 1:1000 survey plot was divided into 33 Map Sheets, reproduced here at a scale of 1:2500 as Appendix F. Fig. 1:3 shows the location of each sheet. While it is acknowledged that loose map sheets are rather vulnerable, it is felt that these are more "user-friendly" for following the description and discussion of the monuments than maps sewn into the binding. A selection of the 550 large-scale drawings are also reproduced.

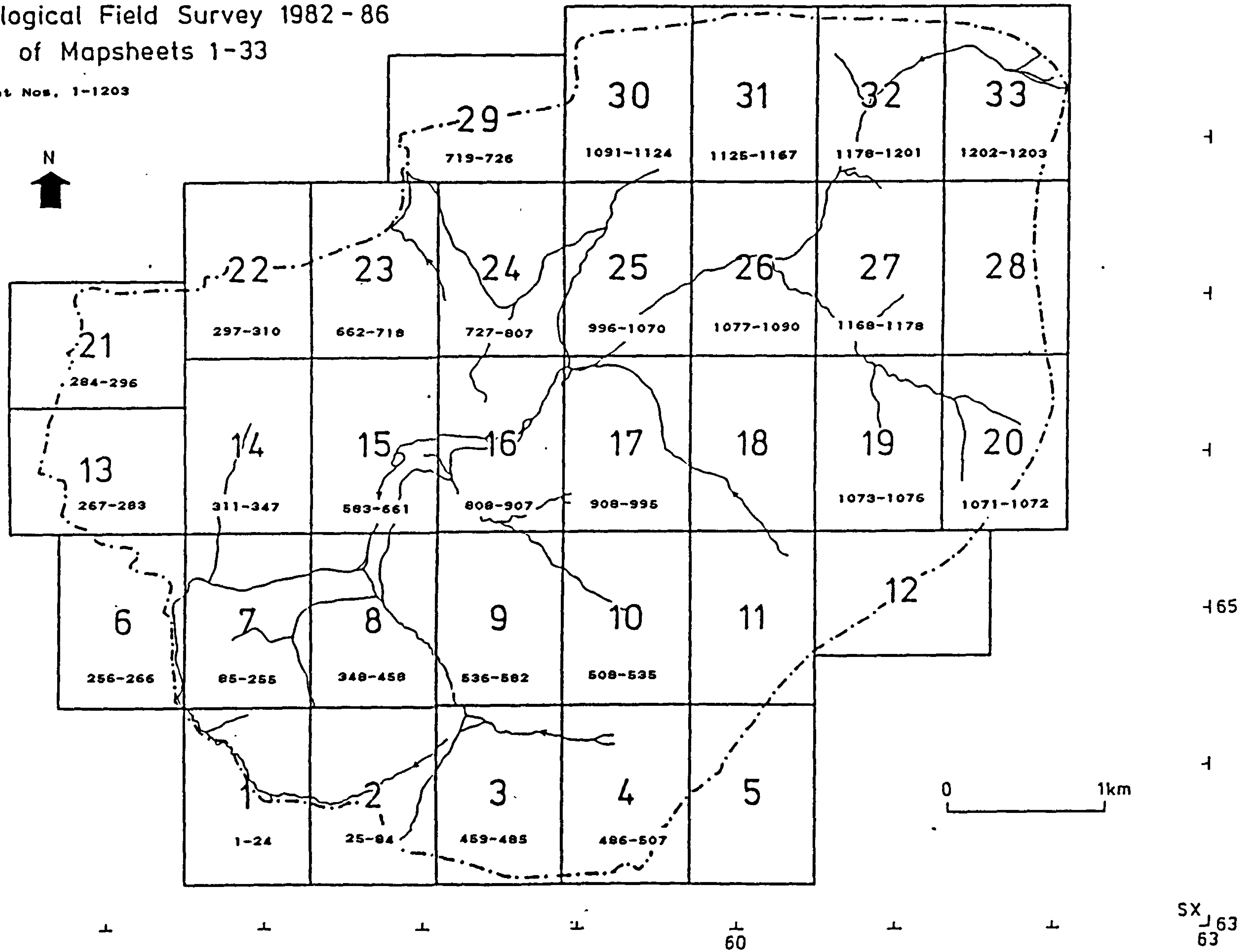
A gazetteer with descriptions and interpretations of nearly 2000 monuments was compiled and is reproduced here as Appendix F. It is accepted that names of monuments are more memorable than numbers. However, the size of the database demands the use of a numbered system but locations are added where possible to assist the reader. References to Map Sheet numbers are kept to a minimum to avoid burdening the text but the relevant map sheet for each monument is listed under the gazetteer entry. The monument numbers occuring on each Sheet are also shown in Fig. 1:3. It should be stressed that no survey can claim to be definitive and new monuments probably await discovery. A list of monuments, recorded by others, but not located between 1982 and 1986 is provided in Appendix G.

Accepting the dangers, noted above, of focussing on separate phases and types of land use, it is still necessary to subdivide the material for

Fig. 1:3

Archaeological Field Survey 1982 - 86
Location of Mapsheets 1-33

and Monument Nos. 1-1203



the purposes of discussion. Most of the monuments fall into four main categories: prehistoric settlement, Medieval agricultural settlement, rabbit warrening and tin working. Each of these will be discussed separately in its own context with reference to similar sites elsewhere on Dartmoor and beyond, and, for the historic period, with reference to documentary sources. However an effort will be made to assess links between the different phases and types of land use at each stage and more fully in the concluding chapter. The greater length of the chapter on tin working reflects the major impact of the tin industry on the landscape in UPV while less emphasis has been given to the prehistoric remains which have been the subject of other recent studies, notably by Smith (1982) and O'Neill (1983). This chapter will concentrate on the contribution made by the present survey, chiefly the provision of large-scale plans of all the hut-circles.

1.5 THE PHYSICAL ENVIRONMENT OF UPV

The physical environment of the valley, particularly geology, geomorphology, soils and vegetation, has exerted a considerable influence on the type of land use and distribution of settlement in UPV. No discussion of the archaeological remains can therefore proceed without some description of their geographical context.

The R. Plym rises at an altitude of 440m-450m O.D. and flows southwestwards, leaving the UPV study area at about 220m O.D. and continuing in a southwesterly direction through SW Devon to Cattewater and Plymouth Sound. It is fed, within the survey area, by a series of tributaries: Crane Lake, Evil Combe, Drizzle Combe, Meavy Pool and Legis Lake on the N bank and Calves Lake, Langcombe Brook, Shavercombe Brook, Hentor Brook, alternatively named Walla or Willa Brook, Spanish Lake and Blacka Brook on the S bank. (see Fig. 1:2) The survey area also includes on the N bank, the head waters of Sheepstor Brook, rising in Gutter Mire. The S bank rises to greater altitudes than the N bank, reaching 480m O.D. above Hentor, Shavercombe and Langcombe Brooks, while the N bank reaches 450m O.D. at Eylesbarrow, but only 350m O.D. on Ringmoor Down.

a) <u>Geology</u>

Most of the valley is underlain by the granite of the Dartmoor boss, the easternmost and largest of the six main outcrops of a single batholith which formed at the end of the Carboniferous period. (Edmonds *et al* 1975, 44) The granite is composed of a combination of quartz feldspar and mica and the granite at Trowlesworthy is sufficiently distinct to be given a separate name, Trowlesworthite, in which the mica and some feldspar is replaced by tourmaline and the quartz by fluor. (Hunt 1910, 413-9)

The present landscape in the Plym valley, like the rest of Dartmoor, is dominated by the tors, visible on both sides of the valley, which were probably produced by a combination of chemical weathering and frost action. (Brunsden and Gerrard 1970, 37) (See Fig. 1:2) Further weathering produced the characteristic jointing of the tors as well as some distinctive features such as the rock basin and "passage" at Gutter Tor. (Worth 1930 98 Figs. 40 and 41, 76 Plate XIII) Weathering by frost action also produced the boulders known as "clitter" which occurs in a dense mass around the tors and also occasionally on slopes such as at Whittenknowles Rocks, where no tor now exists and was presumably totally destroyed. These masses of clitter, the extent of which is marked on the Map Sheets, presumably exerted some influence on the distribution of settlement. Boulders were also moved by solifluction down the slopes below the tors and were sometimes, such as at Hen Tor, sorted into ridges. (Worth 1930, 77 fig. 31)

Further processes within the granite had a profound effect on the economic geography of the valley. Mineralisation of the granite, discussed more fully in chapter five, produced the tin lodes at Eylesbarrow and kaolinisation produced china clay deposits on Lee Moor, worked today immediately to the SW of UPV, and also in some small quantity at Eylesbarrow.

A further geological distinction may also have influenced land use in the valley. A "patch of altered slate" overlies the granite at Ditsworthy extending to Shavercombe Brook, where the waterfall defines the granite/altered slate interface. (Worth 1890, 291) Another tongue of metamorphic rock seems to protrude to the S of Gutter Tor, covering most of Ringmoor Down. (Brunsden and Gerrard 1970, 24 Fig. 2)

b) Geomorphology

Earth movements in the Tertiary period considerably altered the appearance of the Dartmoor landscape. A series of uplifts with consequent re-cutting of rivers, produced a series of terraces or "erosion surfaces" at altitudes, in S Dartmoor, of 1620-1520 ft (474-464m), 1375-1300 ft (419-396m), 1000-875 ft (305-267m) and 820-730 ft (250-223m). (Orme 1964, 46-54: Brunsden and Gerrard 1970, 26-7) Orme suggests that Ringmoor Down is a remnant, at a lower level (up to 350m O.D.), of the 419-396m surface, while the 305-267m surface may also be traced around the southern slopes of Ringmoor Down. (Orme 1964, 51 fig. 3) Otherwise the valley is characterized by relatively gently-sloping plains on the S bank at Trowlesworthy, Willings Walls and Hentor with steeper slopes above, while the N bank rises gently at Drizzle Combe but relatively steeply below Legis Tor and Lower Hartor Tor.

c) Soils

Soil type depends partly on climate, slope and vegetation but also, to a large extent, on the underlying rock and the Dartmoor soils have mostly developed from the weathered granite or growan. These soils have been classified by Clayden and Manley (1964, 122-128) into three main groups, comprising the brown earths known as the Moretonhampstead series, peaty-gleyed podzol soils known as the Hexworthy series and, finally, the blanket bog and peaty gley soils. According to the distribution map, compiled by Clayden and Marley (1964, fig. 1), the Hexworthy series seems to predominate in the granite area of UPV, but blanket bog and peaty gley soils occur above 1500 ft (458m) while the area of brown earths identified at Vigford Down and Shaugh Moor was demonstrated by Price and Tinsley (1976, 151-2) to extend into Trowlesworthy.

The soils, which have developed on the metamorphic zone in UPV are not documented but it seems reasonable to assume that they will reflect their parent material and contrast to some extent with the other soils in the valley.

d) Vegetation

The vegetation pattern has been considerably altered, mostly by human interference, since prehistoric or even Medieval times. (Brunsden and Gerrard 1970, 41) However a description of present vegetation may still be instructive.

According to the Vegetation Map of Dartmoor, produced by the Field Studies Council (1979), seven different vegetation zones or "units" occur in UPV. An area from Eylesbarrow Mine on the N bank to Plym Head and continuing on the S bank to Shavercombe Brook and the higher parts of Hentor and Willings Walls warrens are covered by "blanket bog", which is characterized by heather, cross-leaved heath, common cottongrass, purple moor-grass, deer-grass and moss. The valley bottoms of the R. Plym and its tributaries are defined as "valley bog" with similar vegetation as blanket bog, but without deer-grass. Most of the N bank and the lower parts of the S bank are defined as "heath", characterized by heather and Bristle bent with dwarf shrubs, sedges, coarse grasses and lichens. A small patch of "grassland" is recorded at Gutter Tor, in which the constant species are Common Bent, Sheep's Fescue, Heath Bedstraw, Field wood-rush, Tormentil, Heath grass and moss. Patches of "grassland invaded by bracken" occur around Gutter Mire and Drizzle Combe, along the R. Plym and on Hentor and Willings Walls warrens. Finally, an area of "whortleberry moorland" protrudes into UPV between Shell Top and the Cholwich Town reave and the "grassland with gorse" on Lynch Common extends slightly onto Ringmoor Down.

It may be suggested from first-hand knowledge of the valley that the "grassland" identified at Gutter Tor extends over rather more of Ringmoor Down than indicated on the map. The area on the S side of the Down to the E of Legis Lake and N of the Legis Tor Warren boundary wall may have been subject to recent re-seeding and may correspond to the transitional heath/grassland type which was recorded by Griffith (1979) but could not be included on the Map (taken from aerial photographs). A few trees also occur, chiefly around Ditsworthy Warren House and in the gorge of Shavercombe Brook.

CHAPTER 2: BRONZE AGE SETTLEMENT IN THE UPPER PLYM VALLEY

2.1 INTRODUCTION

A most valuable resource for the study of prehistoric economy and society is provided by the excellent preservation of the stone-built prehistoric remains on Dartmoor. Although early work often concentrated on sepulchral and ceremonial monuments, the settlement evidence, comprising hut-circles, enclosures or pounds, and rectangular fields as well as longer territorial boundaries, or reaves, has increasingly attracted attention. Early topographical writing included descriptions of settlement remains, which are particularly valuable where monuments have subsequently been destroyed, though interpretations were usually highly conjectural (eg. Bray 1838; Rowe 1848; Page 1889; Chudleigh 1893). The foundation of local societies, the Devonshire Association and the Plymouth Institution, in the late 19th Century provided a forum for debate (eg. Kelly 1866; Spence Bate 1871, 1873-4; Ormerod 1872; R.N. Worth 1886, 1890) and speculation on date and function gathered momentum until the end of the century when fieldwork began in earnest.

Following excavations in 1893 at Broadun Ring and Broadun by Robert Burnard (1894) and at Tavy Cleave by the Rev. Sabine Baring-Gould (1894) a major programme of excavations was initiated by the Dartmoor Exploration Committee (D.E.C.) under the aegis of the Devonshire Association. Between 1893 and 1906, with additional seasons in 1935 and 1936, about 200 hut-circles were excavated. (Baring-Gould *et al* 1894, 1895, 1896, 1897, 1898, 1899; Baring-Gould ed. 1902, 1905; Anderson 1906; R.H. Worth 1935, 1937a)

These excavations were of varying quality, and Worth considered that the exploration of only about 120 hut-circles could be "regarded as satisfactory". (1945, 225) Some were conducted at great speed or only minimally recorded but other reports seem to be more thorough and the findings of the D.E.C. remain the most substantial body of excavation evidence for prehistoric settlement on Dartmoor.

A period of consolidation followed, and the D.E.C. reports formed the basis for the first informed discussion on the chronology and economy of the settlements. Thus, in 1927, Curwen evaluated the evidence for cereal cultivation (1927, 281-285) and, later, Brailsford discussed the significance of pastoralism and tin-working in relation to the Dartmoor settlements. (1938, 452-455) In 1945, R.H. Worth published his synthesis of the D.E.C. excavations of hut-circles (1945), having already presented a discussion of the enclosures, based mainly on his own fieldwork. (1943) In 1952, Radford published his interpretation of the D.E.C. excavations, concentrating on the pottery and on morphological distinctions between the hut-circles. (Radford 1952)

The study of Dartmoor settlement received a fresh impetus in the mid-1950's with excavations by Lady Fox at Kestor, near Chagford (1954a) and at Dean Moor, in the Avon Valley (1957), and field survey of hut-circles and enclosures on Gripper's Hill, also in the Avon Valley (Fox, 1955). Simultaneous excavations at Gwithian, in the Hayle estuary, Cornwall (Thomas, 1958) produced a pottery sequence, later supported by the sequence from Trevisker, St Eval, Cornwall (Ap Simon and Greenfield, 1972), which established the first clear relative chronology for SW England. This series of excavations provided a considerably higher quality of information than previously available and stimulated further discussion on chronology and economy. (Fox 1954b; 1964)

Of far-reaching significance was the recognition by Gawne and Somers Cocks that the boundaries of certain long rectangular fields, which they termed "parallel reaves", were pre-Saxon in date. (1968, 289) They mapped the field systems on Holne Moor and at Rippon Tor and recorded others further N on Throwleigh Common, at Kestor and in Fernworthy Forest, and to the south on Shaugh Moor and Wigford Down. (1968, Figs. 1-3) Shortly afterwards, Fleming and Collis (1973) demonstrated a prehistoric date for other boundaries, which delimit large areas of moorland in the upper valleys. In a subsequent series of papers, Fleming established a link between these reaves, along watersheds and along contours, with the parallel reaves in the lower valleys and built up a picture of large-scale territorial organisation with implications for society and economy. (Fleming 1978, 1979a, 1983, 1984, 1988)

Renewed efforts at model-building were assisted by excavations at Shaugh Moor (Wainwright, Fleming and Smith 1979; Wainwright and Smith 1980; Smith *et al* 1981; Balaam *et al* 1982) and at Holne Moor (Fleming 1977; 1979b; 1979c; 1988, 71-93) where attempts were made to establish the relationship between enclosures and reaves, and where, most importantly, the series of C^{14} dates at last provided a framework of absolute chronology for Dartmoor settlements.

Environmental investigations, pioneered on Dartmoor by Simmons (1962; 1963; 1964a; 1964b; 1969) and continued by Staines (1979) and Caseldine and Maguire (1981) provided more information on contemporary land use. Particularly useful work has been carried out in tandem with the excavations at Shaugh Moor (Keeley and Macphail 1981; Beckett 1981; Balaam 1982) and at Holne Moor (Maguire, Ralph and Fleming 1983). A useful paper by Quinnell (1988) correlates the metalwork, pottery, environmental and radiocarbon chronologies.

Thus, a considerable corpus of literature on Bronze Age settlement on Dartmoor has accumulated. It is proposed to discuss the various models for land use, economy and society in more detail below, where an attempt is made to interpret the UPV field survey evidence.

However, it is first necessary to discuss the nature of this evidence. The archaeological evidence relating to prehistoric settlement in UPV falls into three main categories: reaves, enclosures and hut-circles. General observations about these categories are presented below (chapter 2.2), while detailed descriptions of each monument can be found in the gazetteer. (Appendix F)

Certain limitations must be borne in mind when assessing the archaeological evidence. Many monuments in UPV show signs of modification or damage, inflicted in succeeding periods. Occupying the lowest level in the "palimpsest", the prehistoric remains were superceded by Medieval and Post-Medieval farming, tin-working and warrening and, therefore, suffered from the greatest amount of interference. Some prehistoric monuments were modified and reused in later periods and others were cleared to make way for later occupation. Some monuments, such as the enclosure, **Mon 376a**, are recorded, which also seem poorly-preserved but are not associated with any obvious source of dilapidation. While it is tempting to suppose that, in these examples, poor-preservation corresponds to an early date, Medieval or Post-Medieval interference should not be ruled out in any part of the valley, considering the relatively intensive land-use in these periods.

The impact of Medieval or Post-Medieval interference may not always be recognisable in the field, and the present state of each monument, does not necessarily reflect its appearance in the prehistoric period. Even without post-prehistoric disturbance, the condition of any monument only reflects its latest, rather than its initial or "floruit" use. The size, structure or function may have changed during the prehistoric occupation.

Finally, it is most likely that the visible stone remains do not constitute the complete prehistoric settlement. Peat cover may account for apparently empty areas in the distribution of settlements and some monuments may have been completely destroyed. Furthermore, recent excavations have demonstrated that timber may have played a significant part in prehistoric construction. Thus at Kestor and Dean Moor (Fox 1954a; 1957), timber was found to have been used in internal fittings of the hut-circles, while the excavation of a whole enclosure at Shaugh Moor (Wainwright and Smith 1980, 89) and an extensive area surrounding a stone house at Holne (Fleming 1988, 78, 85-6, 91-2) revealed structures, which must have consisted principally of wood and other perishable materials, which would not be detectable in field survey. Evidence was also found at Holne for the enclosure of fields by fences, which again were only revealed by excavation. (Fleming 1988, 89)

Therefore, the archaeological record of prehistoric settlement in UPV may be far from complete or in its original state. Nevertheless the visible remains still form a larger body of evidence than is available in most other parts of the country and invites close examination. The mapping at a scale of 1:1000 of the whole area, and large-scale plans at 1:50 or 1:100 of each individual monument provide a particularly detailed database, with which to begin.

2.2 ARCHAEOLOGICAL EVIDENCE

2.2.1 Reaves

A "reave" is defined as a low stone wall, usually vegetation or turf-covered, symmetric in profile and usually without a ditch. Reaves have been classified by Fleming (1978, 103-5) according to their location and presumed function. Thus long single reaves along watersheds, define large blocks of land or "territories", usually corresponding to valley systems. (*ibid*) Thus the Plym territory, defined by the Eylesbarrow reave, **Mon** 271 and Rook reave, just to the S of UPV, corresponds to one of the four main territories in S Dartmoor, along with the Meavy, Erme/Yealm and Avon. (*ibid.*) Further territories are identified to the N and E, also focussed on river systems and often using rivers, as well as reaves, as boundaries. (*ibid.*)

Subdivision of these territories into a lowland zone and a moorland zone is presumed to reflect economic activities. In the lowland zone, series of long rectangular fields are enclosed by parallel reaves, which terminate at a "terminal reave", equivalent , as Fleming points out (1984, 7), to a Scottish "head-dyke". The latter then marks the "interface between two land-use zones". (Fleming 1987a, 117) The Wigford Down parallel system, butting up to the Eylesbarrow reave and covering about 150ha in the Meavy territory, and the Shaugh Moor system, appended to the Saddlesborough reave and covering about 600ha in the Plym territory, are the best surviving examples of parallel systems in S Dartmoor. Fragments of other systems may be traced in the Erme and Avon valleys at Bittaford and Corringdon Ball respectively. However, Fleming points out that parallel systems were probably destroyed or incorporated and, therefore, sometimes "fossilized" in Medieval and later field systems and that, for example, the Corringdon Ball system may have originally covered c. 1000ha. (Fleming 1978, 103) The best surviving examples of parallel systems are further to the N and E, where the Dartmeet system exceeds 3000ha and Rippon Tor may have covered 4500ha. (Fleming 1983, 197, 220)

At some stage the moorland zone was subdivided into an upland area and a lower "valley zone" by contour reaves. (Fleming 1983, 224) Perhaps the best example in relation to its territory is the Willings Walls/Cholwich Town reave, **Mons 480** and **540**, in the Plym Valley. This may, as Fleming suggests, be part of a much longer reave, continuing westwards across the R. Plym, ultimately to Combshead reave via the wall, **Mon 1121** or bank, **Mon 726**, and eastwards into Penn Moor and Stalldown reaves and possibly even to the Burford and Bullaven reaves in the Erme valley and Corringdon Ball Main reave and Zeal reave in the Avon valley. (Fleing 1978, 103, Figs. 5 and 6; 1988, Fig.22) The Great Western reave is much longer, measuring at least 10.5kms in length, but it is less clearly identified with particular territories in the absence of watershed reaves on western Dartmoor. (Fleming 1978, 103) Certain relationships between boundaries suggested to Fleming (1978, 106-7) that the contour reaves represent a later subdivision of the territories; thus the staggered junction where the Cholwich Town and Penn Moor contour reaves meet the Rook watershed reave suggest the priority of the latter.

Subdivision of the valley zone is exemplified again principally in the Plym valley, namely by the Cross-dyke, **Mon 474**, the Trowlesworthy reave, **Mon 379**, wall-fragments, **Mons 503** and **540e** and possibly the refurbished bank, **Mon 726**. Roughtor Reave, **Mon 719**, which is just inside the survey area, may be a subdivision of the Meavy territory. (Fleming 1978, 117)

The reaves on the S bank of the R. Plym have already been fully recorded by Fleming and Collis (1973) and the whole Plym valley system has been described by Fleming (1978, 117-9). Details are provided in Appendix F, but some comment may be appropriate here. In particular, it is important to note that Willings Walls reave, **Mon 540**, may follow a different course from that previously recorded.

N of Hentor Brook the reave has been reused in a Medieval/Post-Medieval field system and at **Mon. 540f**, this later refurbishment turns further to the NE at an angle of 54°. At this point, Fleming and Collis (1973, 3-5) suggest that the reave continues the NNE alignment towards the R. Plym, possibly, as Fleming further suggests (1978, 117), to join up with Eylesbarrow Reave, using natural features, such as Gutter Mire or Drizzle Combe. However, an assiduous search on the ground between 1982 and 1986, and on aerial photographs has failed to locate this NNE extension. There is a further possibility, which was also put forward as an alternative by the CEU, that the reave may be found beneath the

Medieval boundary. (CEU 741) This continues to the NE after **Mon 540f** and forms the main NE-SW axis of the northern Hentor field system.

The sharp angle of **Mon 540f** should not preclude the contemporaneity of both elements of the reave; it may be interpreted as a re-alignment on a spur, similar to the change of direction on a spur at SX 5818 6515. Excavation of parts of the eastward extension might establish if the Medieval boundary is indeed constructed on a reave base. However, two elements of the boundary, in the fields, **Mons 847a** and **966a**, consist simply of a single line of orthostats. (See Plate 2:1) These presumably correspond to "block-walls". While Fleming and Ralph (1982, 106) suggest that block walls are usually early Medieval in date, they add that:

> "On some parts of Dartmoor it may be difficult to distinguish block-walls from reaves with absolute certainty, since reaves vary considerably, and may include orthostats and boulders. Stretches of reave exhibiting these characteristics are found within the study area [ie. Holne Moor] but they are normally short and their role as parts of reaves is clear".

Plate 2:1
The reave-extension, **Mon 540** in field **Mon 847**.

Furthermore, orthostat facings are visible elsewhere on the reave, especially between the farmstead, **Mon 543**, and the structure, **Mon 565**. (Sheet 9) Regardless of origins, the continuation of the possible reave after **Mon 540f** is referred to here as the "reave-extension" and shares the same number as the Willings Walls reave, **Mon 540**.

The further possibility may be considered that parallel reaves underlie some of the Medieval boundaries, which define the long, rectangular fields on either side of the reave-extension. The intervals between these boundaries are within the range of intervals between parallel reaves elsewhere. Furthermore, there is evidence of a contemporary boundary associated with the reave, W of **Mon 540f**. This boundary now consists of two short fragments, **Mon 540e**, and was probably disturbed by the Medieval refurbishment. Originally, it may have joined the wall, **Mon 825**, and the enclosure, **Mon 824a** and its presence suggests that reaves adjoining the main reave cannot be ruled out. However, it is unlikely that parallel reaves would be found in this location, so far above the Saddlesborough terminal reave. Nevertheless, it is still possible that reaves, such as those at Stannon, to the N and W of the Warren House Inn, which define larger areas, interpreted as "blocks of pasture", underlie some of the Medieval boundaries. (Fleming 1988, 37-38)

A re-routing of the Willings Walls reave to Shavercombe Brook does not affect its role in the proposed Combshead-Stalldown contour reave; from Shavercombe Brook, the boundary could still have run up Drizzle Combe to, for example, **Mon 1121**.

2.2.2 <u>Enclosures</u>

a) <u>Introduction</u>

The settlement evidence in UPV, comprising enclosures and hut-circles, can be divided into discrete groups, which occupy geographically well-defined areas. (See Table 2:1 and Fig. 2:1)

Table 2:1 Settlement areas in the Upper Plym Valley

North Bank	South Bank
Legis Tor	Trowlesworthy House
Gutter Tor	N. Trowlesworthy
Eastern Tor	Trowlesworthy Tors
Whittenknowles	Lower Cholwich Town
Drizzlecombe	Upper Cholwich Town
Lower Hartor Tor	Willings Walls
Eylesbarrow	Spanish Lake
Crane Lake	Lower Hentor
	Upper Hentor
	Shavercombe Tor
	Giant's Hill
	Lower Langcombe
	Upper Langcombe

There are also a few isolated hut-circles, which are set apart from these groups, namely **Mon 407** between N. Trowlesworthy and Trowlesworthy Tors, **Mons 566** and **567** on the Willings Walls Reave, and **Mon 714** on the northern edge of Ringmoor Down.

It is interesting to note that one major complex of enclosures is situated in almost every settlement area. Thus multi-lobed enclosures, occur at Legis Tor (**Mons 224a-228**) and Willings Walls (**Mons 585a-592a** and **b**), while one group of at least three conjoined enclosures is found at Trowlesworthy House (**Mons 173a-175a**), Trowlesworthy Tors (**Mons 69a-71a**), Spanish Lake (**Mons 555a-c**), Eastern Tor (**Mons 886a-888a**) and Giant's Hill (**Mons 1000a-1002a**). The very large single enclosures, **Mons 490a** and **747a** may be the equivalent at Cholwich Town and Whittenknowles Rocks.

The distribution reveals a strong concentration of settlement along the R. Plym, though large settlements also occur at some distance from the river. S- or SW-facing slopes were preferred, presumably to provide some shelter from the most severe winds on Dartmoor, the North-Westerlies, though more exposed locations, such as Gutter Tor and Eylesbarrow, were also occupied. A concentration of settlements may also be observed within, or adjacent to, areas of clitter, such as Upper Hentor, Eastern Tor and Whittenknowles. These locations may have been chosen deliberately for their ready supply of building material or to release clitter-free areas for other activities such as grazing. In general, settlement decreases with increased altitude; this may be attributed to peat growth, though the depth of peat in UPV seems insufficient to conceal settlements and no evidence was found during the survey and mapping of peat-cutting areas.

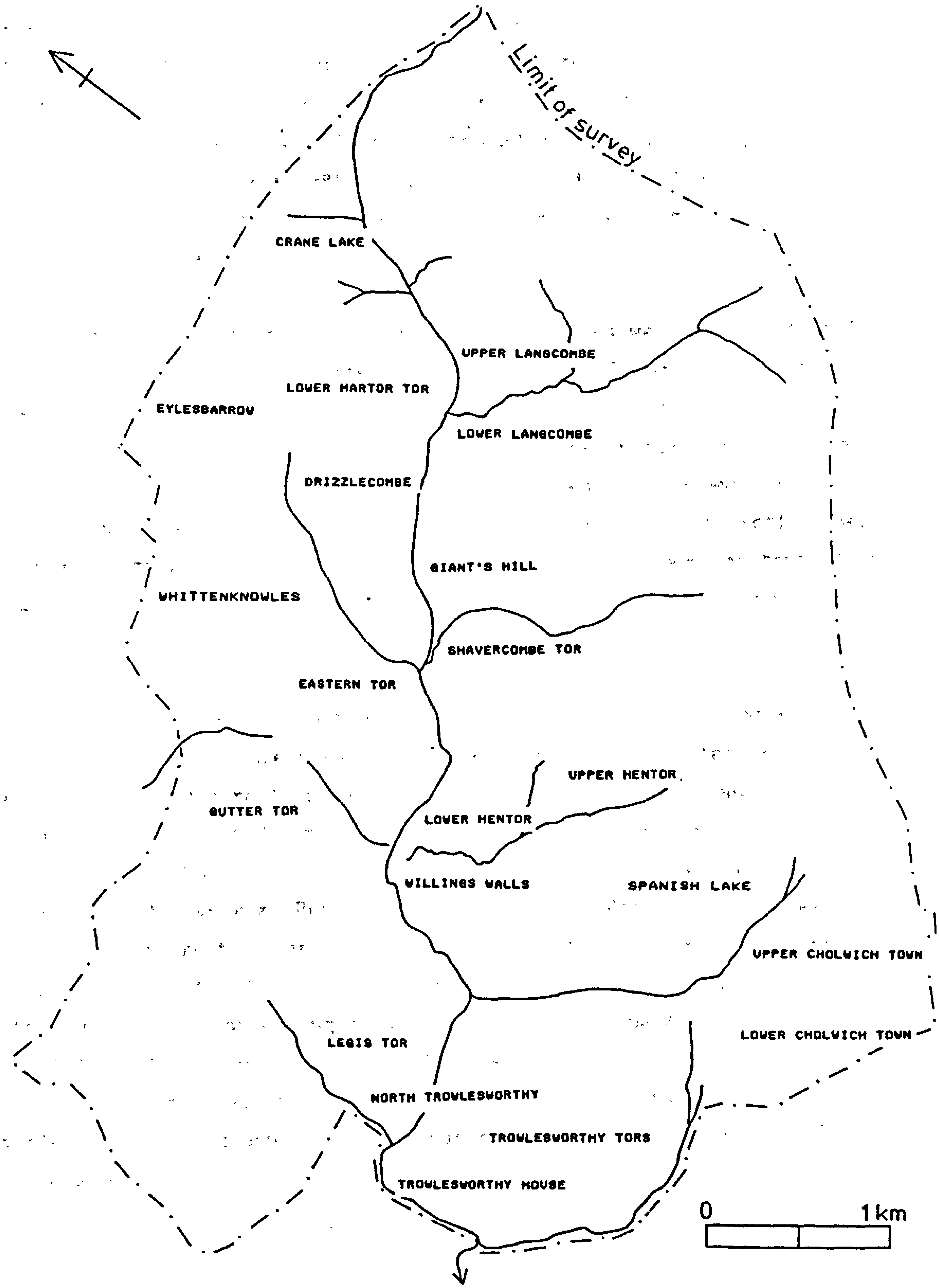


Fig. 2:1 The Location of Bronze Age settlement areas in UPV

The absence of settlement in other areas, such as the S slope of Ringmoor Down and to the S and W of Ditsworthy Warren House, may be attributed to Medieval disturbance, though, in the former case, it is difficult to believe that all traces of prehistoric settlement were swept away, while the stone row and circle, **Mon 274a** and **b**, stone circles, **Mons 266** and **272**, cairns, **Mons 280, 281, 297, 298, 299** and **311** and cist, **Mon 312**, all survived. Therefore, the present lack of settlement may reflect the original distribution.

It may be significant that these two areas, as well as the steep N-facing slope of the Hentor interfluve (between the Lower Hentor and Shavercombe Tor settlements) which is also without evidence of prehistoric settlement, are all situated on the metamorphic zone, which protrudes into the granite area of UPV. These would have been free of clitter and, therefore, may have been reserved for particular activities, such as grazing. Alternatively, settlements may have been constructed of timber and turf, and any slight traces, such as levelled platforms, would easily have been destroyed by the Medieval land use.

115 enclosures are recorded in UPV, although, if two or more conjoined enclosures are considered as a single, agglomerated or compound enclosure, this figure is reduced to 83. Six enclosures (**Mons 89a, 92a, 112a, 884, 936** and **1175**) may be of Medieval or Post-Medieval origin and are only tentatively included. Most of the enclosures are ovoid in plan, though two, **Mon 490a** at Upper Cholwich Town, and **Mon 1078a** at Lower Langcombe, are rectilinear. Enclosures range in size from small single pounds, such as **Mon 1039a** (0.10ha in internal area) and **Mons 148a** and **366a** (0.18ha), to large single enclosures, such as **Mon 490a** (1.29ha) and **Mon 747a** (4.03ha), or conjoined enclosures, such as **Mons 224a-226a** (1.82ha). Discussion of these enclosures will concentrate on the variations in structure and on the number and location of internal structures.

b) <u>Structure</u>

The perimeter walls of enclosures in UPV range in structure from substantial, well-built examples, such as the Cholwich Town enclosure, **Mon 490a**, **Mons 56a** and **148a** at Trowlesworthy, **Mons 224a, 249a** and **455a** at

Legis Tor, and Mon 1050a at Drizzlecombe to relatively slight constructions, such as Mons 366a and 376a at Trowlesworthy Tors and Mon 219 at Legis Tor. Unfortunately it is not known how much these distinctions depend on later disturbance rather than the original method of construction. As noted above, the present condition of the archaeological remains only reflects the latest use or disturbance of the monuments. However, on the basis of the available field evidence, clear differences in construction technique can be identified.

Perhaps the most striking construction technique is that of the double-faced wall, which consists of an inner and outer face of slabs or orthostats, containing a rubble core. The clear contrast between this and walls consisting of irregularly-shaped boulders, occasionally arranged singly in a line, but usually crudely piled up and often incorporating groundfast clitter must be a consequence of the original construction rather than differential preservation. (FN 1) Another type of wall, in which smaller stones or rubble are piled up in a "dump", represents a further method of construction, though occasionally a dump wall may simply be the remains of a double-faced wall, after the facing slabs have been removed.

The double-faced wall was used in all the most substantial and well-preserved enclosures, listed above. The double wall-face can rarely be traced around the whole perimeter of the enclosure, though sufficient evidence of inner and outer facings occurs in other enclosures to suggest that this was the sole method of construction. (Eg. Mons 228a, 453a, 490a, 824a, 964a, 982 and 1050a) Some evidence of the double wall-face is also found to varying degrees in Mons 224a, 225a, 226a, 249a, 469a, 585a, 586a, 587, 588a, 589a, 670a, 887a, 888a, 904a, 952a, 1034a, 1042a, 1078a and 1087a.

While robbing, refurbishment and demolition may explain the discontinuity of the double wall-face in many enclosures, there is also clear evidence to suggest that some enclosures were originally built using more than one method of construction.

FN 1 "Groundfast" refers here to a naturally-occurring embedded stone or boulder and is distinguished from "earthfast" which may be applied to a man-made feature.

Walls consisting of large, crudely piled-up boulders are a clear contrast to the carefully-constructed double-faced wall and occur throughout the valley. (Eg. **Mons 482, 510a, 517b** and **c, 819a, 825, 1058, 1120a** and **1179a**) These often incorporate groundfast boulders. (Eg. **Mons 53a, 93, 452a, 517a, 518a, 525a** and **c, 702** and **1110a**) These boulder walls are hardly a result of robbing or refurbishment and, therefore, when this type of construction occurs in conjunction with the double-faced wall, it may be assumed that this constitutes the original structure.

Thus, the N sector of **Mon 12a**, at Trowlesworthy Tors, consists of a double row of orthostats with a rubble core, while, apart from the Medieval refurbishment of the W sector, the enclosure is otherwise defined by a boulder wall. Similar arcs of inner and outer facings are visible within the boulder walls of **Mons 207a** and **250a** at Legis Tor, **Mon 502a** at Upper Cholwich Town and **Mon 1122a** at Eylesbarrow. The double-faced wall also occurs in conjunction with other methods of construction. Thus, coursed masonry is visible between arcs of facings at **Mon 507a** at Upper Cholwich Town while a combination of dump and double-faced construction is found at **Mons 56a, 359a** and **366a**, all at Trowlesworthy Tors. The latter could be a result of partial robbing, but the number of enclosures consisting entirely of walls of relatively small rubble, often visible as turf-covered banks, suggests that this was an original building method. (Eg. **Mons 20a, 101a, 227a, 229, 533, 546a, 547a, 555a, 590a, 591, 884, 997a, 1000a, 1001a, 1002a, 1021a, 1079, 1174**) Some, such as **Mons 618a, 620a, 665a** and **665d** at Gutter Tor, W of a major Medieval field system, may still be a result of robbing.

More complex constructions also occur. A combination of a double-faced wall, dump wall and coursed masonry occurs at enclosure, **Mon 1039a** at Drizzlecombe while the Whittenknowles enclosure, **Mon 747a**, consists of a substantial boulder wall including facing slabs in the N sector, and a turf-covered mostly dump wall but with some facings in the NW and SSW sectors. The use of several techniques within a single enclosure is supported by excavation evidence. Thus, while the Round Pound at Kestor was found to consist of an almost continuous double-faced wall (Fox 1954, 37, Fig. 6), enclosure 15 at Shaugh Moor revealed several building methods, often meeting abruptly. (Wainwright and Smith 1980, 72) An abrupt transition between two types of wall structure was also observed in House 1 on Site B at Holne Moor. (Fleming 1979b, 5; 1988, 87 Fig. 34) It seems reasonable to conclude, like Wainwright and Smith (1980, 72) and Fleming (1979b, 5) that this evidence of varied methods is a result of gang-labour. However, as Wainwright and Smith also point out, "it is difficult to understand the absence of even a limited overall co-ordination of the work that would have resulted in a uniform or symmetrical structure". (1980, 72) The outlines of composite-structure enclosures in UPV seem to be relatively smooth and regular, though excavation is required to establish if this is really the case. However, surface evidence suggests that they lack the marked kinks in alignment, such as those recorded along some reaves and attributed to gang-labour. (eg. the kink in Willings Walls Reave, **Mon 540d**. (Fleming and Collis 1973, 4)) This implies an element of corporate planning and execution, and it must, therefore, be wondered why the selection of materials was not also a central policy decision.

It is possible that different construction techniques are, alternatively, a reflection of the underlying geology. R.H. Worth detected a reluctance to transport materials for domestic structures over even a relatively short distance. (1943, 275) He observed that the dump-walled hut-circles (probably **Mons 948-951**) to the W of Shavercombe Tor and lying on the edge of the tongue of altered slate, which protrudes into the Plym Valley, were built of the underlying slate, while granite, more suitable for double-faced construction, was available at the tor. (*ibid.*) The dump construction of enclosures and hut-circles on Giant's Hill (**Mons 996, 997a-e, 998, 999, 1000a-g, 1001a-b, 1002a-b**) and Ringmoor Down (**Mons 618a-b, 619, 620a, 621, 622, 623, 662, 663, 664 and 665a-d**) may also be explained by their location on this metamorphic zone and the use of immediately adjacent materials. Therefore, possibly the boulder construction of the N sector of Whittenknowles enclosure, **Mon 747a** is simply a result of its proximity to heavy clitter, which is absent around the W and S sectors, where the wall consists mostly of dump construction.

However, this does not preclude the use of gang-labour. It is difficult to imagine how a huge enclosure like Whittenknowles could have been built without the use of a large labour force. Each gang could have used a variety of building methods according to available materials, and gang junctions would not necessarily correspond to changes in technique.

A closer connection between construction methods and particular gangs might be established by excavation, if interfaces between types of wall structure coincided with even slight kinks in alignment.

Otherwise, regularity of outline may have been achieved by the preliminary placing of orthostats as markers, as suggested by Wainwright and Smith (1980, 74). This seems a plausible explanation for the occasional tall orthostats found in many enclosures, which have no structural significance, such as in a gateway. These include the 1.20m high orthostat in the N sector of Whittenknowles enclosure, **Mon 747a**, the single orthostats in the W and N sectors of **Mon 1050a** at Drizzlecombe and the intermittent orthostats up to 1m high in **Mon 1087a** at Lower Hartor Tor. Other examples occur in double-faced wall construction (**Mons 148a, 156a, 175a, 224a, 228a, 349a, 455a, 502a, 585a, 586a, 587, 588a, 670a, 817a, 823, 952a, 1034a, 1042a** and **1078a**) and in boulder walls (**Mons 504a, 510a, 819a** and **825**). Groundfast boulders may have served a similar purpose; thus the perimeter wall of enclosure, **Mon 452a** at Legis Tor, simply joins up groundfast clitter as well as pre-existing hut-circles.

Finally any connection between structure and chronology must be considered. It may be significant that the latest constructions in two of the largest enclosure complexes in UPV are built in a different method from the earlier phases. Thus at western Legis Tor, horizontal stratigraphy and the overall plan indicate that **Mon 227a** subdivides and thus post-dates **Mon 226a** (and, therefore, also **Mons 224a** and **225a**) and that **Mon 229** abuts and post-dates **Mon 226a** (and, therefore, also **Mons 224a** and **225a**). (Sheet 7) Analysis of structure reveals that **Mons 224a, 225a, 226a** and **228a** all consist of double-faced construction, while **Mons 227a** and **229** are dump walls of mostly small stone rubble. This implies that **Mon 227a** may be contemporary with **Mon 229**, and, therefore later than **Mon 228a**, which is a sequence impossible to detect by horizontal stratigraphy alone.

Similarly, at the Willings Walls enclosure complex (Sheet 15), the evidence of double-faced construction, albeit limited after robbing, in the earliest enclosures, **Mons 588a** and **589a**, and subsequent additions, **Mons 585a, 586a** and **587**, contrasts with the dump construction of stone rubble in **Mons 590a, 591** and **592a** and **b**. **Mons 591** and **592** are demonstrated by horizontal stratigraphy and the overall plan to be the latest enclosure walls on the site; the similarity of the construction of **Mon 590** with, at least, **Mon 591** suggests that this, too, is relatively late and post-dates the adjacent enclosure, **Mon 585a**.

However, on present evidence, the distinction between types of structure as a chronological indicator cannot be extended from such localized situations to the whole valley. As noted above, dump walls of small rubble could reflect the underlying geology rather than chronology.

c) <u>Internal Features</u>

i) <u>Gateways</u>

Although many enclosure walls are breached by gaps, few of these can be interpreted with any certainty as gateways. Only those gaps, which are flanked, across the width of the wall, by orthostats, facing slabs or coursed masonry may be positively identified as such. Thus orthostats flank gaps in the E sector of **Mon 148a** at Trowlesworthy House, SW sector of **Mon 504a** at Upper Cholwich Town, N sector of **Mon 817a** at Lower Hentor, N sector of **Mon 996** at Giant's Hill, SW sector of **Mon 1042a** at Drizzlecombe and the SE side of **Mon 1078a** at Lower Langcombe. A pair of orthostats lying across the wall in the SE sector of **Mon 366a** at Trowlesworthy Tors and the NE sector of **Mon 1087a** at Lower Hartor Tor may also indicate an entrance, though any original gap is partly rubble-filled. In the W sector of **Mon 462a** of Lower Cholwich Town, two large orthostats, one lying straight and the other obliquely across the wall, may indicate an entrance leading into a passage flanked by yards, **Mons 462d** and **e**, though again the gap is filled in.

Large facing slabs or faced boulders line openings in the N sector of **Mon 12a** at Trowlesworthy Tors, NE sector of **Mon 502a**, SE sector of **Mon 507a** both at Upper Cholwich Town, E sector of **Mon 904a** at Eastern Tor and the E sector of **Mon 1034a** at Drizzlecombe. Coursed slabs flank a clear entrance, 1.80m wide, through the NE face of the Cholwich Town enclosure, **Mon 490a**. Another gap in the SW side of the same enclosure may be another entrance, adjacent to a structure, **Mon 490c**, which could then be interpreted as an entrance-works. At Lower Hartor Tor a dilapidated structure, **Mon 1087e**, next to a gap in the E sector of enclosure, **Mon 1087a**, could also be interpreted as an entrance-works, S of another possible entrance already noted.

Occasionally only one side of a gap is stone-lined, but this may also represent an original gateway, as in the E sector of **Mon 462a**, the W and S sectors of the Whittenknowles enclosure, **Mon 747a** (**Mons 747b** and e respectively) and in the SE sector of **Mon 1050a**. A possible third entrance into **Mon 747a** may be indicated by a gap in the W sector (**Mon 747c**), flanked by expanded terminals. This arrangement is also visible in the SW and SE sectors of **Mon 70a** at Trowlesworthy Tors, on one side of a gap in the S sector of **Mon 982** at Shavercombe Tor, opposite a tall orthostat, and again on one side of a gap in the NW sector of **Mon 1000a** at Giant's Hill.

Many of these entrances are 1m or less in width, for example 0.40m at **Mon 817a**, 0.60m at **Mon 507a**, 0.65m at **Mon 1034a**, 0.80m at **Mon 12a** and 1m at **Mons 502a, 747b** and **c** and **996**. Some are considerably wider such as 1.80m in the NE face of **Mon 490a**, 2.50m at **Mon 1078a**, 3m at **Mon 982**, 3.20m in the E sector of **Mon 462a**, 3.50m at **Mon 1000a** and 6m at **Mon 747e**.

Other constructions, such as turf-covered banks built at right-angles to the enclosure wall may be interpreted as Medieval or Post-Medieval modifications, particularly as these all occur in enclosures with other evidence of later disturbance. (**Mons 225b, 226b** and in enclosure, **Mon 588a**) The many gaps without structural features in other enclosures cannot be interpreted as entrances without excavation.

Only a few enclosures, including **Mon 93** at Trowlesworthy Tors, which may be Medieval or Post-Medieval, **Mons 358a** also at Trowlesworthy Tors, **823a, 824a** both at Lower Hentor and **964** at Shavercombe Tor, have apparently unbroken perimeters, but excavation is required to establish if these were definitely without gateways, as demonstrated at enclosure 15 at Shaugh Moor. (Wainwright and Smith 1980, 74)

ii) Hut-Circles

The number and location of hut-circles within enclosures varies considerably. No internal structures have been detected in 22 enclosures, though, of these, four may be Medieval or Post-Medieval and are discounted from this discussion. (**Mons 93, 884, 936 and 1175**). A further eight are attached to enclosures, which do contain hut-circles, and, therefore, the absence of structures may be less significant. (**Mons 175a, 229, 250b, 587, 591, 592a and b, 605d and 1042b and c**)

Of the remaining enclosures, five show clear evidence of later damage. Thus the Medieval rebuilding, which almost obliterated **Mons 911 and 974**, could easily have also destroyed any hut-circles. Similarly, structures could have been located in the portions of enclosures later truncated by tin-working (**Mon 982**) or by the construction of leats (**Mons 219 and 1079**). The other five (**Mons 238, 482, 953, 996 and 1058**) are also incomplete for unknown reasons and, again, structures could have existed in the now missing sectors. Thus it cannot be claimed with certainty that any of the prehistoric enclosures were "empty" and, moreover, it must be remembered that the presence of timber structures in any of the enclosures cannot be detected without excavation.

A similar qualification applies to enclosures which do contain stone structures. The number of extant hut-circles varies from a single hut-circle in **Mons 53a, 823a and 1039a** to 38 hut-circles in Whittenknowles enclosure, **Mon 747a**. These structures can be more or less centrally-located within the enclosure, such as in **Mons 53a, 349a, 490a, 504a, 518a, 747a, 904a, 1078a, 1120a and 1122a**, or carefully arranged around the perimeter, for example in **Mons 12a, 507a, 546a, 546b, 817a, 824a, 964a and 1000a**. The significance of the number and location of hut-circles within enclosures is discussed further below.

iii) Plots

A number of enclosures also contain smaller internal enclosures, which have been described here as plots or yards. Most are sub-rectangular, though some are D-shaped, oval, trapezoidal or irregularly-shaped. The method of construction contrasts with that of most of the hut-circles; they are defined by relatively low insubstantial boundaries, often low, narrow turf-covered banks, but occasionally by a setting of

Table 2:2 Plots within enclosures in the Upper Plym Valley

Enclosure	Plot	Size	Shape	Structure
Mon 12a	12d	15m x 4m-11m	ovoid	turf-covered stones
	12e	8.20m x 7.80m	S-R	turf-covered wall; few stones visible
Mon 20a	20f	13.50m x 9.50m	trapez	small stones in turf mound
Mon 70a	70b	9.70m x 7m	S-R	turf-covered banks; small stones and orthostats
Mon 207a	207b	10m x 4m	D	row of single boulders
Mon 225a	225c	6m x 5m	S-R	1 course of medium-sized boulders; levelled
	225h	8m x 7m	S-R	earth and stone bank
Mon 226a	226i	4m x 3m	S-R	rubble wall of medium-sized boulders
	226j	4.5m x 4m	S-R	rubble wall of medium-size stones
	226k	?	?	semi-circular arc of wall
Mon 227a	227f	8m x 4m	S-R	low earthen bank; some stones
Mon 228a	228d	11m x 7m	S-R	irregular stones; some edge-set
	228e	10m x 9m	S-R	earth and stone bank
Mon 249a	249b	11m x 8m	S-R	earthfast boulders
	249g	10m x 8m	S-R	small and medium-sized stones; levelled
Mon 455a	455d	17m x 8m	S-R	1 or 2 layers of small stones
	455e	8m x 5m	S-R	1 layer of small stones
	455f	8m x 7m	R	rubble wall
	455k	10m x 8m	S-R	setting of boulders
Mon 462a	462d	9.80m x 4.60m	irreg	turf-covered wall; few stones visible
	462e	12.30m x 5m	S-R	turf-covered wall
	462f	17.60m x 13m	S-R	turf-covered wall; a few stones visible
	462h	17m x 11.5m	S-R	turf-covered wall; a few stones
Mon 469a	469e	9.60m x 6.20m	D	turf-covered wall; a few stones
	4691	10m x 9m	irreg	turf-covered wall; a few stones
	469r	10.30m x 6m	S-R	turf-covered wall; a few stones
Mon 555a	555d	7m x 7m	S-R	turf-covered bank; a few stones
	555e	23m x 11m	D	overgrown hummocks
	555f	13m x 8m	irreg	turf-covered wall
Mon 747a	789	6m x 5.5m	S-R	scatter of irregular stones, singly or in pairs
	790	17m x 10.50m	S-R	crudely-built; irregularly-shaped boulders
	791	12.5m x 11.5m	S-R	low narrow wall of stones
	792	18m x 11m	S-R	irregularly shaped and placed stones

NOTES S-R = Sub-Rectangular; S-C = Sub-Circular; D = D-shaped; Irreg = Irregular;

single boulders (**Mons** 207b, 225c and 455k), a wall of piled-up boulders (**Mons** 226i, 226j and 249b) or a rubble wall of smaller stones (**Mons** 455d, e and f). Facing stones or orthostats are consistently absent. (See Table 2:2) All abut the enclosure wall, which indicates that all belong to the enclosure phase and are presumably associated with some activity in the enclosure. Some, of course, may be post-prehistoric; in particular the yards, **Mons** 789-792 at Whittenknowles enclosure are probably associated with the adjacent Medieval settlement, **Mons** 785-7. The easternmost yard, **Mon** 792, is bounded by a bifurcation of the internal enclosure wall, **Mon** 788a, which seems to be of Medieval refurbishment, if not Medieval construction.

The distribution of enclosures with plots does not seem to be dictated by altitude: plots occur between 259m and 366m O.D. However, plots are restricted to the SW part of UPV, and in particular to Trowlesworthy, Lower Cholwich Town, Spanish Lake and Legis Tor. This may suggest that the activities associated with plots are restricted to these areas, but this fails to take into account the possibility that similar rectilinear enclosures were built elsewhere of timber.

d) The evidence for chronological depth

i) Enclosures

A study of enclosures provides considerable evidence for chronological depth within the pattern of prehistoric settlement in UPV. The clearest evidence may be detected in the horizontal stratigraphy and overall plan of the multi-lobed enclosures, notably at Legis Tor, **Mons** 224a - 229 and at Willings Walls, **Mons** 585a - 592. The sequence of construction at each site is summarized, following the principle of the Harris-Winchester matrix, in Fig. 2:2. (Harris 1975, *passim*)

Other multi-lobed enclosures are spread throughout the valley. For example, to the N of Trowlesworthy Warren House, **Mons 175a and 174a** are later additions to the original enclosure, **Mon 173a**. To the W of the Trowlesworthy Tors, **Mon 69a** seems to be the earliest of three enclosures and was abutted by **Mon 70a**, which was in turn abutted by **Mon 71a**, though here the sequence is confused by the incorporation of groundfast boulders

Fig 2:2a Matrix Analysis of the Legis Tor Enclosure Complex.

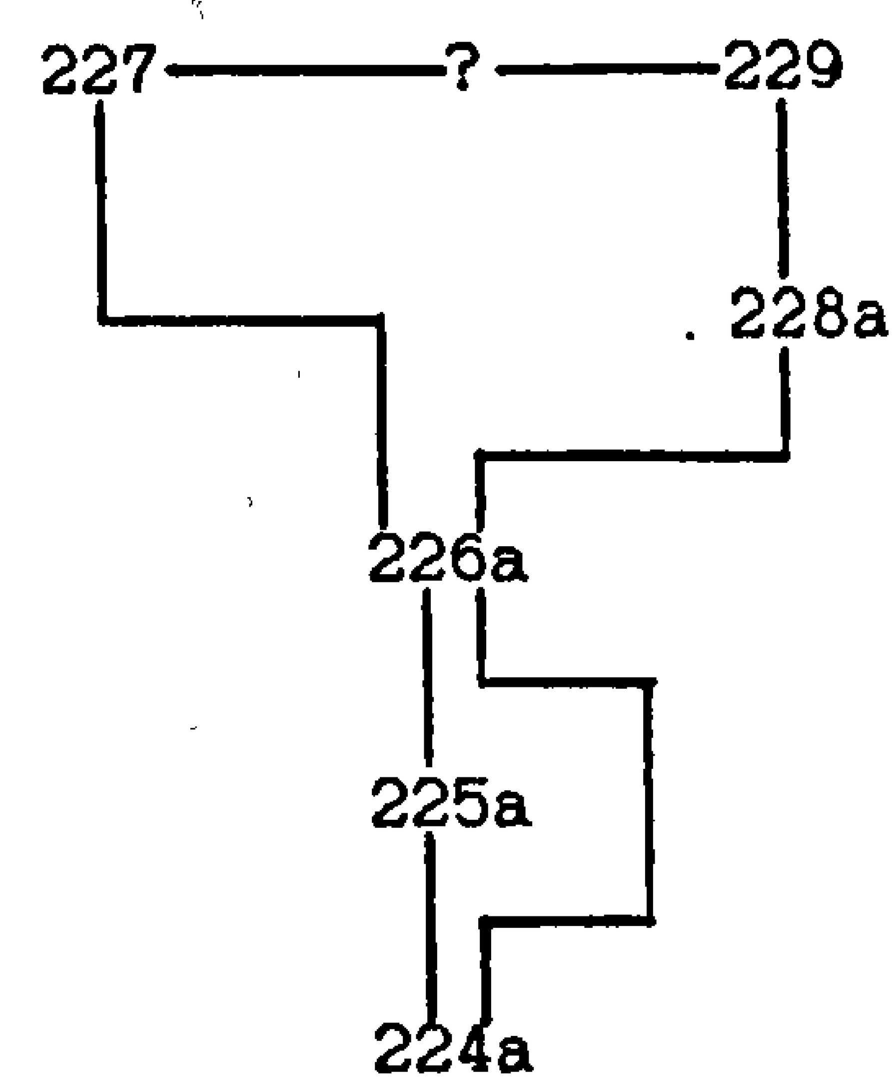
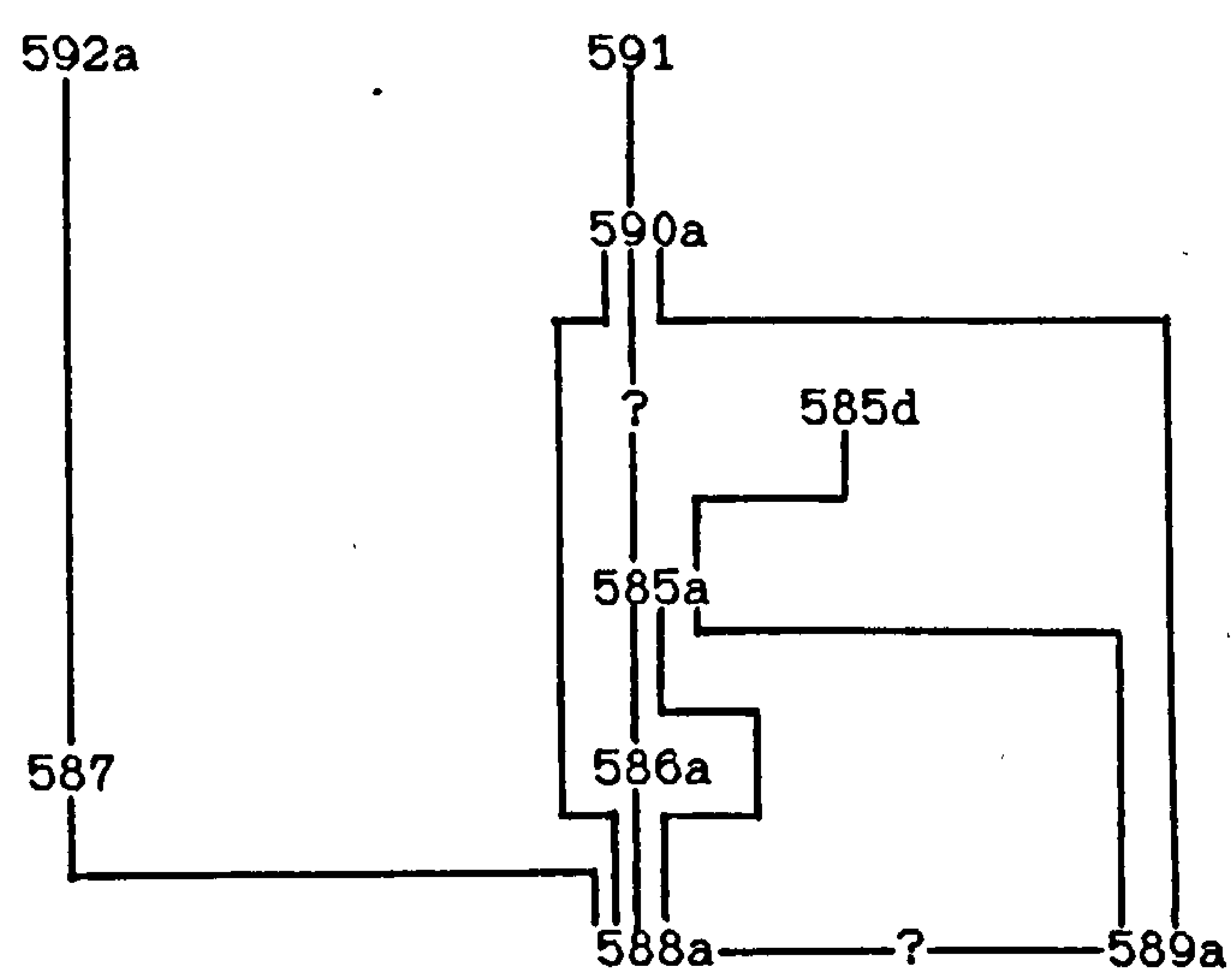


Fig 2:2b Matrix Analysis of the Willings Walls Enclosure Complex.



in the walls, and by post-prehistoric refurbishment. At Spanish Lake, the SW end of the enclosure, Mon 555a, up to the partition wall, Mon 555c may represent the earliest phase, later extended up to the partition, Mon 555b and finally to the full length of the enclosure. At Eastern Tor, Mons 886a and 888a may have formed two discrete, possibly contemporary, enclosures, later joined together by Mon 887a, while finally, at Giant's Hill, Mon 1000a seems to be primary with Mon 1001a attached on the W side, and both abutted by Mon 1002a. (For full details see Appendix F)

Less complex sequences, consisting of the addition of a single annexe to an existing enclosure, also occur. Examples include the addition of Mon 359a to Mon 358a at Trowlesworthy, of Mon 469b to Mon 469a at Lower Cholwich Town, of Mon 547a to Mon 546a at Spanish Lake, of Mons 517b and c to Mon 517a and of Mon 819a to Mon 817a at Upper and Lower Hentor, and of Mons 1042b and c to Mon 1042a and of Mon 1050b to Mon 1050a, both at Drizzlecombe.

Thus there is considerable evidence of chronological sequences within the enclosures. It might be argued that additional lobes were added after only short lengths of time and even that a group of conjoined enclosures could have been built according to a single pre-conceived plan. However, in many cases the extra lobes are clearly designed to enlarge the original enclosure after it had been in use for some time; common walls between the original enclosure and its annexe have frequently been demolished or simply lowered as if to provide access between the two, an action which would hardly be necessary if they were planned as a single unit. For example, at Legis Tor, the evidence for robbing in the E sector of Mon 224a and the NE sector of Mon 225a suggests deliberate provision of access when Mon 226a was built. Similarly the less substantial nature of the E side of Mon 226a suggests that it, in turn, was partially dismantled when the enclosure was enlarged by Mon 228a. Again robbing in the SE sector of Mon 358a, at Trowlesworthy Tors, presumably occurred when Mon 359a was added, while, at Giant's Hill, the barely visible SW sector of Mon 1000a and S sector of Mon 1001a were probably dismantled in successive phases. The extension of Mon 555, at Spanish Lake, may account for the vestigial nature of the walls, Mons 555c and b, which had, in turn, formed the NE boundary. Finally, at Eastern Tor, the W sector of Mon 888a seems to have been completely demolished, probably when Mon 887a was added.

Further evidence of chronological depth may be implied by the sub-division of enclosures by partition walls, which abut the outer perimeters and are occasionally of a different structure. However there are very few examples (Mons 226c, 227a, 249e and f, ?452b, 455b, 952b and 1000b) and any significant time-lag between the outer perimeter and the internal divisions cannot be demonstrated.

Finally, there is some evidence to suggest chronological depth within the Whittenknowles enclosure, Mon 747a, where curvilinear walls seem to form internal sub-enclosures. (Sheet 24) At least one of these may be part of a pre-main enclosure phase and consists of the SW sector of the main perimeter wall, running from Mon 747e to Mon 747d and continuing into the internal wall, Mon 750. The apparently integral junction between these two elements is reinforced by the position of the tall orthostat, Mon 747d; this is aligned as if to form the outer face of the rounded corner of an early enclosure. This enclosure probably incorporated hut-circles, Mons 765 and 766 in its perimeter and may have enclosed, Mons 751-754, though the original eastward extent is unknown. An alternative interpretation is that the internal walls, Mons 750 and 748a and b, continued south-westwards into the external "apron", Mons 797a-c, to form an early enclosure. (O'Neill 1983, 121, Fig.) However, this is contradicted by the integral relationship between Mons 750 and 747a, and because Mon 797a is not directly in line with Mon 748a. It is perhaps more likely that Mon 797a-c, was built after the main enclosure wall, using the internal walls and, particularly, the orthostat as markers. Indeed, the rectangular plan and the ditch along the N side suggest Medieval refurbishment, if not Medieval construction. However, the composition and curvilinear plan of the adjacent "apron", Mon 799, may reflect prehistoric origin, though the original extent is unknown; the E sector may have continued into the earth and stone bank, Mon 794.

Other walls within the main enclosure run between hut-circles, for example, Mons 763b, 765b, 766b, 769d, 770b and 771b. However, these could be a form of partitioning after the main enclosure was built, similar to Mon 226c at Legis Tor, joining up hut-circles, Mons 226d, e and f, and do not necessarily belong to an early phase. More plausible is the arc of wall, Mon 748c, which, although it abuts a hut-circle, Mon 757, it does not simply join up existing structures. The original extent is unknown; it may have continued southwards into Mon 748b, but the northern element, Mon 748d, is more likely to be a later addition, designed to partition the W end of the enclosure, after the main perimeter was built.

Another sub-enclosure, formed by Mons 788a-c may also belong to an early phase, though the original sequence is difficult to ascertain because of Medieval disturbance. The NE sector, Mon 788c consists of a turf bank, possibly indicating Medieval refurbishment if not construction, associated with the attached plots, Mons 790-792 and possibly Mon 789. However, the SW and NW sectors, Mons 788a and b seem to be of prehistoric construction associated with the hut-circles, Mons 783 and 784, but the relationship between Mon 788a and the main perimeter wall is masked by further Medieval interference.

ii) Enclosures and hut-circles

Perhaps of greater significance to the interpretation of the settlement pattern is the evidence for chronological depth within the relationship between enclosures and hut-circles. Horizontal stratigraphy and the overall plan demonstrate that many hut-circles pre-date the enclosures. Thus numerous hut-circles are abutted by their enclosure wall. (FN 1) There are also a few examples of enclosures formed by joining up several hut-circles, to resemble a "string of beads", notably Mon 452a at Legis Tor, which incorporates four hut-circles. Mon 533a at Upper Hentor may be another example, though heavy vegetation masks the relationship between enclosure and the three hut-circles, which could also be interpreted as integral. Other examples include Mon 824a at Lower Hentor though there is a possibility that two of the four hut-circles (Mons 824b and d) post-date the enclosure, and Mon 555a at Spanish Lake, though, here, the group of conjoined hut-circles, Mons 555n, o and p and 2

FN 1 Mons 12i, 20b and 20e, 69b, ?70e, 101b, 174c, 224b and 224c, 250c, 358b, 359d, 455g and ?455j, ?469q, 510b, 517i, ?546b and ?546c, 585b, 586b, 588h, 590c, 665b and 665c, 817b, 823b, 1000g, 1001b, 1050f and 1050g.

another hut-circle, Mon 555g, may be integral with the wall. Finally, Mon 518a at Hentor incorporates three hut-circles in its perimeter, while enclosing four others.

It must be noted that the simple abuttal of a hut-circle by its enclosure wall does not necessarily demonstrate any significant time-lag between the two constructions. Indeed, O'Neill argues that the relatively smooth outline of the "string-of-beads" enclosures suggests that these were pre-planned. (1983, 127) However, "strings-of-beads" are clearly not so regular as other enclosures, particularly Mons 452a, 555a and 824a, and it could also be argued that, for example, at the latter an equally smooth enclosure could have been constructed to include other free-standing hut-circles to the SE. (Mons 828-830) Thus the alternative view that "strings-of-beads" do imply a time-lag is preferred here.

More positive evidence of distinct chronological phases can be found in several enclosures where the wall clearly kinks, either to incorporate a pre-existing hut-circle (FN 1) or to avoid enclosing it (FN 2). This is hardly a result of forward planning and must be attributed to two separate phases. It also raises further questions, such as the significance of excluding particular hut-circles.

Thus it can be demonstrated that a significant number of hut-circles were originally unenclosed. Furthermore, many of the centrally-located hut-circles, which have no visible relationship with the enclosure wall may also ante-date the enclosure. This is supported by stratigraphic and C^{14} evidence from enclosure 15 at Shaugh Moor: thus the drains of houses 18 and 66 underlay the enclosure wall, while C^{14} dates from houses 15, 18, 66 and 67 (between 1480 bc and 1310 bc) are all earlier than the date from the enclosure wall (1210 bc). (Wainwright and Smith 1980, 82, 85, 118-9)

FN 1 Hut-circles, Mons 56e and f, 148e, 173b, 174b, ?207c, 227b, ?366e, 469u, 518b, and c, ?555m, 670b and g, ?904b, 952d and ?e, 997b, 1042d.

FN 2 Hut-circles, Mons 223a, 248, 250d and 1001b.

iii) Differential preservation

Differential preservation is another possible indicator of chronological depth, though more difficult to assess. Wainwright and Fleming noted that enclosures 16 and 25 on Shaugh Moor had been robbed, in order to build other enclosures. (1979, 9) Within UPV examples were recorded above of the removal in antiquity of parts of enclosure walls to provide access to appended enclosures, and it is also possible that some of the incomplete enclosures are a result of prehistoric robbing. For example, **Mon 517a** at Upper Hentor and **Mon 1058** at Drizzlecombe could have been quarried to supply adjacent enclosures. O'Neill also suggests that the more dilapidated appearance of some enclosures may be a result of prehistoric robbing. (1983, 120-1) For example, she contrasts the poorer preservation of **Mon 452a** at Legis Tor and **Mon 366a** at Trowlesworthy Tors with adjacent enclosures. (*ibid.*)

However, on account of the great amount of post-prehistoric activity in UPV, it is difficult to positively attribute evidence of robbing to the prehistoric period. Moreover, apparently poorer preservation could reflect a different method of construction, and, as O'Neill points out, some building techniques may be more prone to collapse. (1983, 120) Therefore, differential preservation is perhaps a less useful guide to chronological depth in UPV.

2.2.3 Hut-circles

a) Introduction

The major component of the prehistoric settlement evidence in UPV consists of the stone foundations of buildings, known as "hut-circles". This terminology is not entirely satisfactory; analysis of the remains reveals that the hut-circles are anything but circular in plan, often forming an oval or sometimes more irregular shape. Moreover, on the grounds that the term is demeaning for structures which are far from crude and primitive, Fleming advocates the replacement of "hut-circle" by the term "house". (1979a, 117) This seems a good policy in the discussion of excavated evidence, where the domestic function of a structure can be demonstrated. However, it may be misleading to apply a term, with implications of domestic function, to field survey evidence, where the function of every structure cannot be established. Therefore, on the grounds that the term is well-known, and keeping the limitations in mind, "hut-circle" is retained here.

416 hut-circles were recorded in the UPV area, of which all but three were drawn at a large-scale, mostly at 1:50 and some at 1:100. A further 24 roughly-circular, levelled terraces, defined, if at all, by only a few boulders, were identified and have been designated "hut platforms". (FN 1) An additional 16 structures, which are visible as heaps of stones or arcs of stone-walling may be interpreted as ruined hut-circles. (FN 2) Finally, eight structures, which occur in prehistoric enclosures but are irregularly-shaped, are tentatively included as hut-circles, but could be a result of Medieval interference. (FN 3)

This brings the total number of hut-circles in UPV to 464, a density of 20.40 hut-circles per km². Comparison of data from such an intensively-surveyed area as the Plym valley with data from other parts of Dartmoor may be misleading. However, when R.H. Worth plotted the distribution of the 1330 Dartmoor hut-circles, known in 1945, the OS Map Sheet CX11SE, which covered an area of six square miles on Trowlesworthy and Ditsworthy Warrens, had the second highest density of hut-circles, after the Upper Yealm Valley. (R.H. Worth 1945, 227) At that time, only 136 hut-circles had been recorded in the Plym Valley, producing a density of 8.88 per km². (*ibid*)

Thus recent fieldwork has multiplied the density by a factor of 2.30 and it is possible that intensive survey over the whole of Dartmoor would result in a corresponding increase from the 1945 total. Worth had already suggested in 1945 that the total number of Dartmoor hut-circles might be nearer 1500, while Hamond in 1979, using published surveys and aerial photographs recorded over 2000. (*op.cit.* 226; Hamond 1979, 146) However, using a multiplication factor of 2.30 from the 1945 total, the

FN 1 Mons 56b, 207c x 4, 225f, 226g, 227e, 228c, 455c x 2, 670c, 670d, 670g, 670i, 702d, 885b, 904d, 1040, 1044, 1045, 1078b, 1078d, 1110f.

FN 2 Mons 12h, 12?, 12k, 23, 65, 87, 112b, 173c, 349h, 507 x 3, 515b, 1019, 1021b, 1034b.

FN 3 Mons 469i, 469j, 469k, 469n, 469o, 469p, 555k, 555l.

mean density of 2.04 hut-circles per km^2 would rise to 4.69 per km^2, accounting for a total of 3062 hut-circles on Dartmoor.

It is possible that some or all of the 24 hut platforms are the remains of timber or turf structures. Such platforms, particularly without any stone foundation are very difficult to recognise. All those recorded in UPV occur in enclosures, where, perhaps, field walking is more intensive. However, hut platforms may remain undetected on open land, where, particularly, in heather-covered areas, they would be very difficult to locate.

Further discussion will concentrate on variations in size and structure and on the significance of enclosure.

b) Size of hut-circles

Perhaps the most significant characteristic of a hut-circle, in relation to its function, is its internal size. Several attempts have been made to document and interpret variations in size among Dartmoor hut-circles. Thus in an analysis of 137 accurately-measured hut-circles, Worth found that internal diameters ranged between 6 ft (1.83m) and 32 ft (9.75m), with a mean value of 17 ft (5.19m), but with marked peaks at 10 ft (3.05m) and 15 ft (4.58m). (R.H. Worth 1945, 229)

However, it may be suggested that internal area is a more accurate representation of size. Few hut-circles are truly circular, so that comparison, even of mean diameters may be misleading. Thus, using a planimeter on large-scale plans, wall-faces are more readily identified, while any irregularities in outline are easily accommodated. Plotting these readings produces a smoother curve, from which size-groups may be distinguished without being misled by any minor irregularities.

The walls of a few hut-circles have degenerated into widespread overgrown banks, within which the original wall faces cannot be detected, and these have not been included in the analysis. (FN 1) Similarly hut-

FN 1 Mons 546b, 553b, 665c, 772, 940 x 2, 948, 949, 952c, 997b, 997c, 997d, 997e (N and S), 998, 1002b, 1034c.

circles which are incomplete, or have been too badly-damaged to allow estimation of internal area are necessarily eliminated. (FN 1) Also omitted are the 24 "hut-platforms" (see above p. 40 FN 1) and the 24 structures which are only tentatively interpreted as prehistoric hut-circles. (see p. 40 FNs 2 and 3)

This reduces the sample to 375, but it is felt that this reduction is compensated by the greater degree of accuracy. Plotting the readings to the nearest $2m^2$ produced a smooth curve in which several features are worthy of comment. (See Fig. 2:3) Internal floor area ranges from $2m^2$ to $69m^2$, though 97% of the sample falls between $4m^2$ and $55m^2$. Of particular interest is the asymmetrical nature of the curve. The biggest concentration occurs at the lower end of the scale, and the curve drops gradually from a peak between $4m^2$ and $11m^2$ to the maximum recorded floor area of $69m^2$. Seven size-groups can be distinguished and are summarised in Table 2:3.

Table 2:3 : Size-groups of UPV hut-circles

Size-Group	Size	Number	% of Total
1	under $4m^2$	6	1.60%
2	$4m^2$-$11m^2$	137	36.53%
3	$12m^2$-$19m^2$	90	24.00%
4	$20m^2$-$29m^2$	87	23.20%
5	$30m^2$-$39m^2$	31	8.27%
6	$40m^2$-$55m^2$	19	5.07%
7	$56m^2$-$69m^2$	5	1.33%
		375	100.00%

The small size of floor may be significant; although some hut-circles reach $69m^2$, only 14.67% measure $30m^2$ or over. The number of hut-circles in size-group 2, is particularly remarkable; 36.5% fall within a range of only $8m^2$, which may indicate that this size-group was preferred for a particular function. It is interesting to note the abrupt drop in numbers below $4m^2$. 34 hut-circles measure between $4.0m^2$ and $5.99m^2$ in internal floor area, but only six are recorded below $4m^2$. It may even be possible to eliminate these six from the category of hut-circles. Thus **Mon** 349h could be a result of late interference, associated with warrening, **Mon** 560 could alternatively be interpreted as a cairn, while **Mons** 555m and 1021e could be entrance-works into the enclosure, **Mon**

FN 1 **Mons** 12g, 20b, 56d, 69b, 156e x 2, 502c, 590d, 664, 714, 783, 784, 819c, 952d, 964c, 1000c-f, 1000g, 1042d.

FN 2 **Mons** 40, 358c and 454 are also omitted as they were not drawn at a large scale.

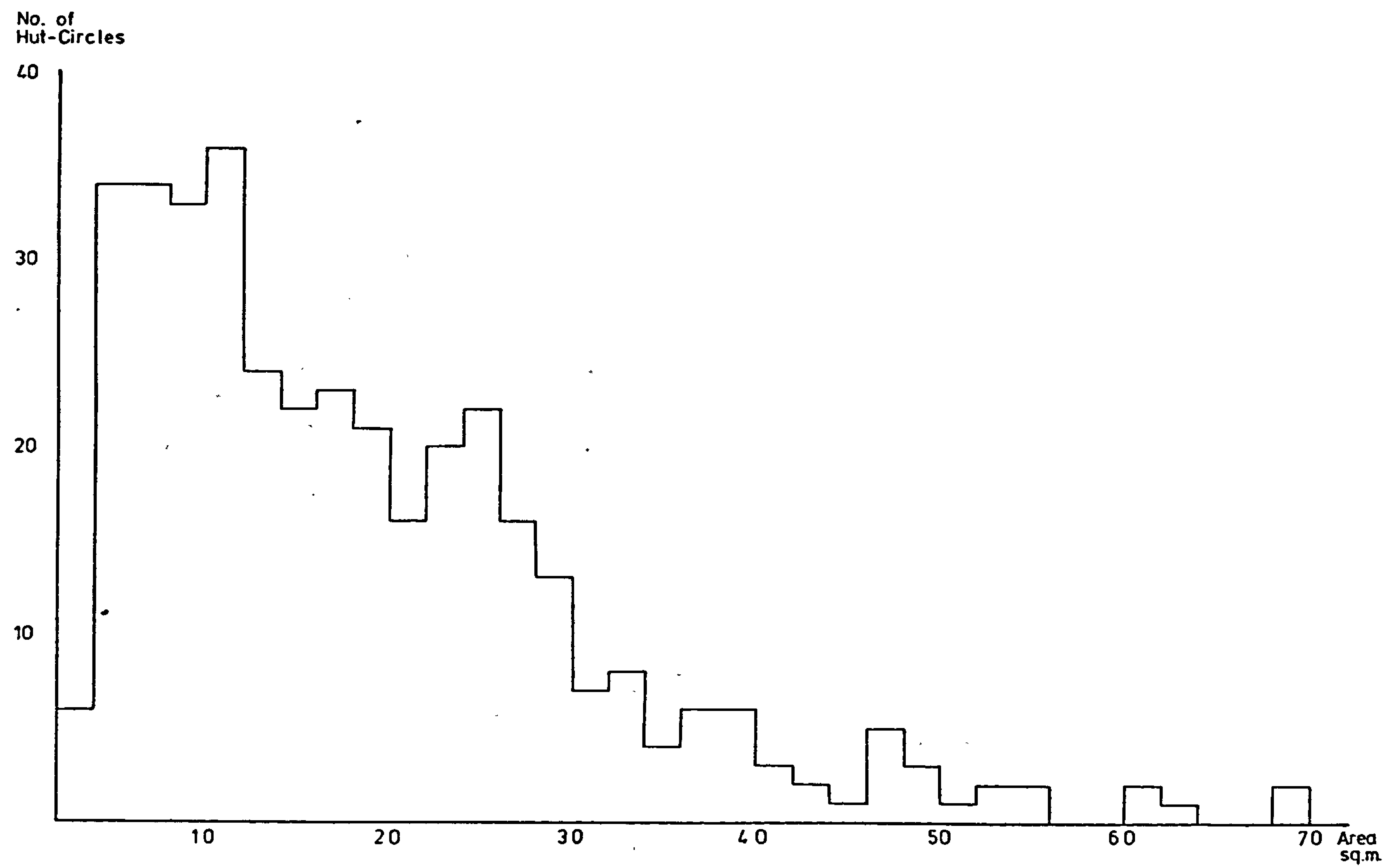


Fig. 2:3 Internal area of hut-circles in UPV

555a, and the conjoined hut-circles, **Mons 1021c** and **d**, respectively. The remaining two small hut-circles are situated within enclosures and may have some subsidiary function.

This seems to indicate that $4m^2$ is the lowest optimum floor area for a hut-circle, regardless of function, though in the ethnographic record, seasonally-occupied shielings of about 1.8m in diameter ($2.54m^2$) and as little as 1m-1.2m in diameter ($0.95m^2$) have been documented in Scotland. (Miller 1967, 208)

c) <u>The relationship between size and altitude</u>

Of particular interest is the relationship between size and altitude. In a statistical test carried out on data from the Plym Valley (in the area above the Saddlesborough Reave and between the Eylesbarrow and Rook Reaves) Susan O'Neill demonstrated that the internal area of hut-circles on the S bank was dependent on altitude. (1983, 153, App. 5, calculation 2) This contrasted with the N bank where area did not depend on altitude. (*ibid.*) These contrasting relationships are repeated in the UPV survey area and are illustrated in Figs 2:4 and 2:5. Thus on the N bank, no particular pattern emerges in the distribution of hut-circles, which are relatively evenly-spread through the ranges of internal area and altitude. However, on the S bank a clear concentration of small hut-circles, between $4m^2$ and $12m^2$, occurs above 335m-343m O.D. Below this altitude, the distribution appears, like the N bank, to be evenly-spread.

In a further statistical test, the internal areas of hut-circles on the S bank, were shown by O'Neill to depend on their relationship with the Willings Walls Reave, **Mon 540**. Thus, the difference between the mean house size above the reave and the mean house size below the reave was found to be "extremely significant". (1983, 170, Fig. 8:8) Again this contrast in sizes, above and below the reave on the S bank is evident in the UPV area and is illustrated in Fig. 2:6.

A total of 132 hut-circles was recorded above the Willings Walls Reave, but 23 were not measurable. Thus out of a sample of 109 hut-circles, 88 were $12m^2$ or under, in internal area, ie. 80.73%. The distribution suggests that $12m^2$ is the critical upper limit of "small"

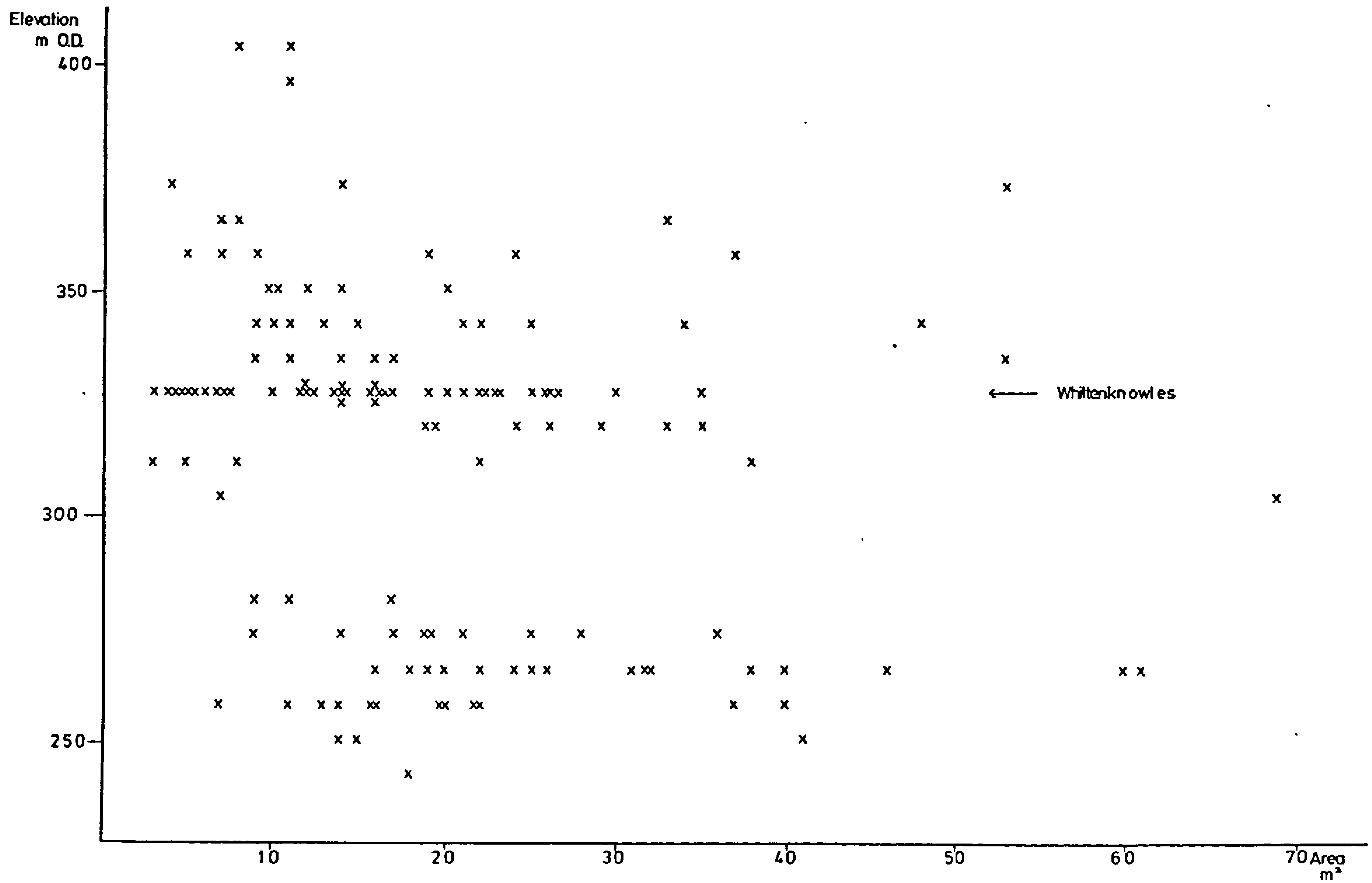


Fig. 2:4 The relationship between internal area and altitude in hut-circles on the north bank

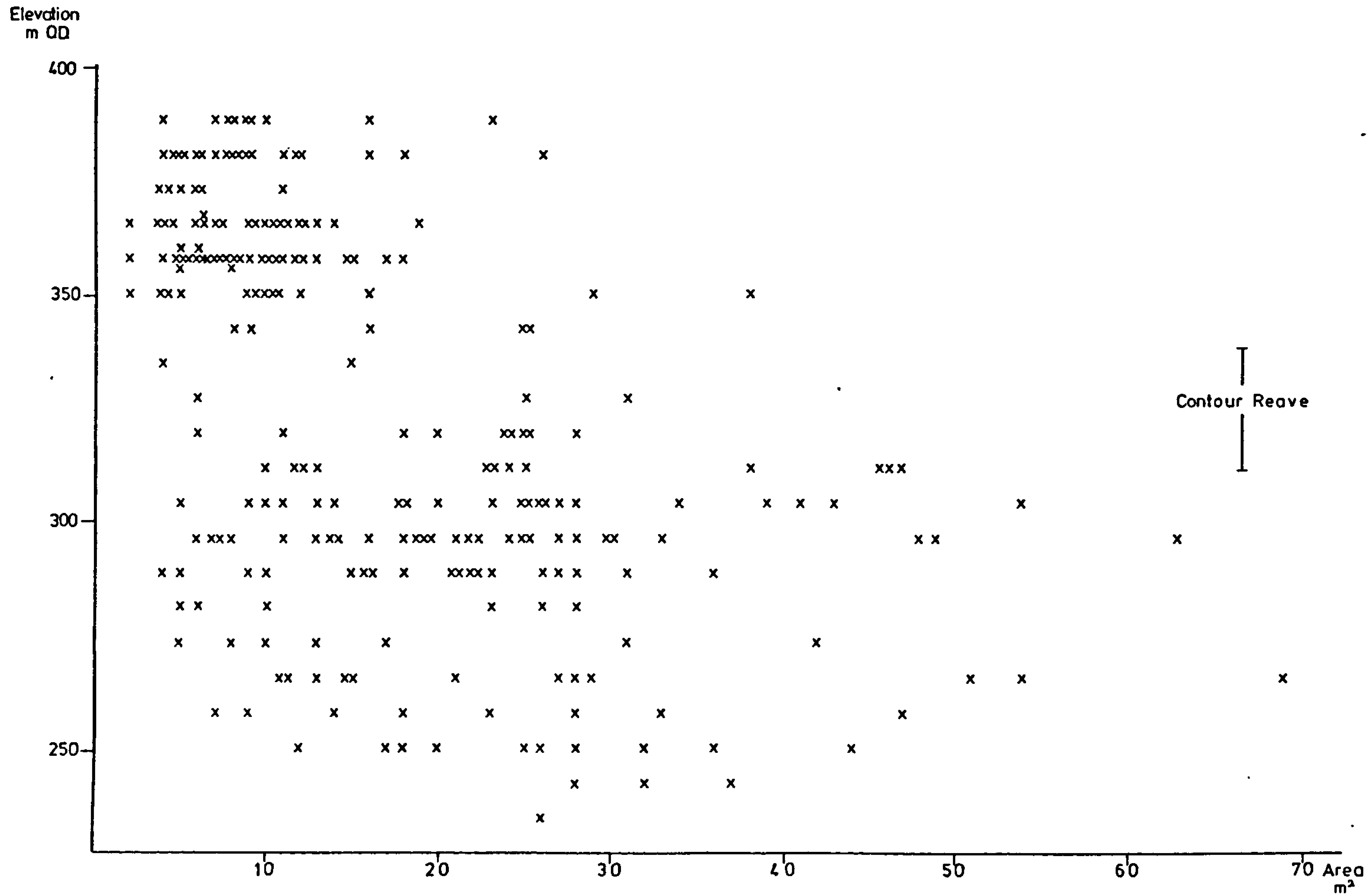


Fig. 2:5 The relationship between internal area and altitude in hut-circles on the south bank

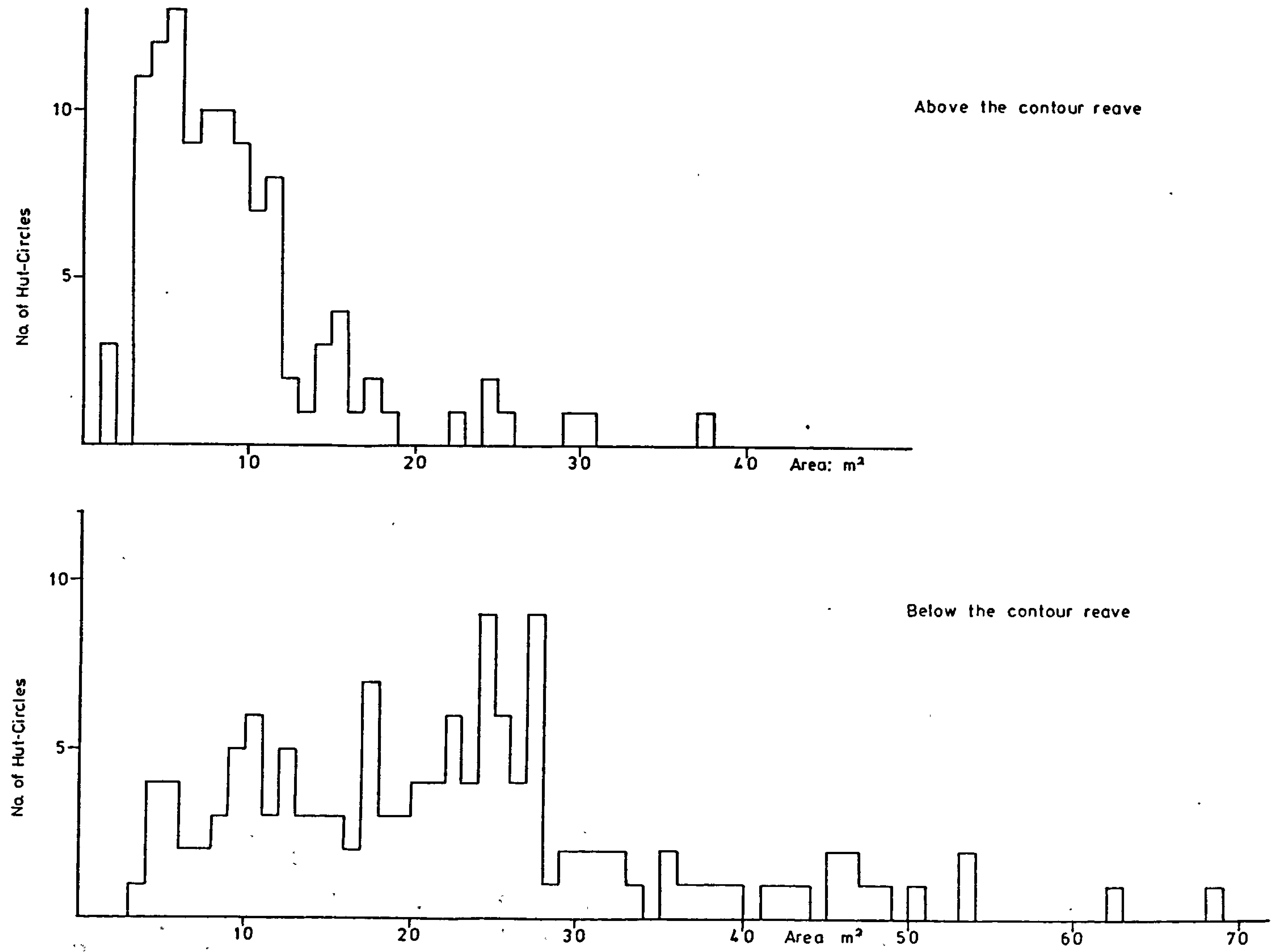


Fig. 2:6 Internal area of hut-circles above and below the Willings Walls / Cholwich Town contour reave

hut-circles, rather than $11m^2$, which seemed to mark the upper limit of size-group two in the analysis of the total UPV sample. (See above Fig. 2:3 and Table 2:3) Thus there is a distinct drop from eight hut-circles at $12m^2$ to two hut-circles at $13m^2$.

Furthermore, only 6.42% of the hut-circles are above the $20m^2$, which O'Neill suggests is the minimum size to house a nuclear family and therefore most may have been designed for seasonal occupation. (1983, 144) The larger hut-circles may have had some specific function, and some may not have been hut-circles; for example, **Mon** 567 adjacent to the reave, may have been a pre-existing ring cairn.

In clear contrast, out of a sample of 135 measurable hut-circles below the reave, only 30 are $12m^2$ or under in internal area, ie 22.22%. 79, ie. 58.52%, are $20m^2$ or over and, therefore, suitable for year-round occupation. Thus the the Willings Walls Reave appears to define a boundary within UPV between upland and lowland settlement. The possibility that this reflects a different economic emphasis, with seasonal occupation above the reave and permanent settlement below, will be discussed further below. (See 2.3.3)

The possibility that the size-distinction might be repeated on the N bank of the R. Plym, above and below the proposed continuation of the Willings Walls Reave, was also considered. 29 hut-circles were recorded above this continuation, defined by Drizzle Combe, Narrator Brook and two walls running NNW from the Eylesbarrow Reave (**Mons 1121 and 1122b**), though two were not measurable. However, no preponderance of smaller hut-circles was revealed, only 55.55% were $12m^2$ or under in internal area, while areas of up to $53m^2$ were recorded. This may suggest that the proposed continuation of Willings Walls Reave is less significant than the reave proper, and possibly non-existent. However, the sample is very small, and other factors may be taken into account; for example, some of the largest hut-circles above the reave-continuation are in the Drizzlecombe area (**Mons 1035, 1036, 1037, 1042e, 1042f, 1050f and 1050g**) and their size may reflect some association with the Drizzlecombe sanctuary.

d) The relationship between size and relative chronology

The possibility that size varies according to relative chronology may also be considered. The database of hut-circles, which can be demonstrated to be "early" or "late" from surface indications alone, is very small and depends principally on the relationship between the hut-circles and their enclosures. It, therefore, cannot take into account the many hut-circles, which have no demonstrable relationship with an enclosure. Nevertheless, a comparison is interesting and reveals a tendency towards larger size among the "early" hut-circles. Thus out of a sample of 58 measurable hut-circles, which are earlier than their enclosures, only 24.13% are $11m^2$ or under in internal area, compared to 38.13% of the total UPV corpus, while 27.6% are in size-group 3 ($12m^2$ - $19m^2$) and 32.8% are in size-group 4 ($20m^2$ - $29m^2$) compared to 24% and 23.2% respectively in the total sample. (See Fig. 2:7)

By contrast hut-circles, which are later than or contemporary with their enclosures are smaller than average. Thus out of a total of 41 measurable hut-circles, 53.66% are $11m^2$ or under in internal area, 12.19% are in size-group 3 and 26.83% are in size-group 4.

e) Structure

Excavation evidence from Dartmoor hut-circles suggests that, as in the case of enclosures, several distinctive methods of construction were used. Unfortunately the large corpus of material from the D.E.C. is less informative on structure as the committee concentrated on interiors and rarely described or illustrated more than the inner wall-face. However, R.H. Worth investigated the full width of the wall, at least at Hut 1, Metherel (1935, 122) and later identified three main types of construction used in the Dartmoor hut-circles. (1945, 230-2)

The double wall of slabs or orthostats with rubble fill is similar to that already described with reference to enclosures. This type contrasts with single face construction, in which an inner face of flat slabs or "liners" could be backed by dry-stone masonry or a combination of dry-stone with an outer turf bank and revetment of small "toe" stones, (1945, 230) for example at Hut 1, Metherel. (1935, 122 Fig. 13) A third

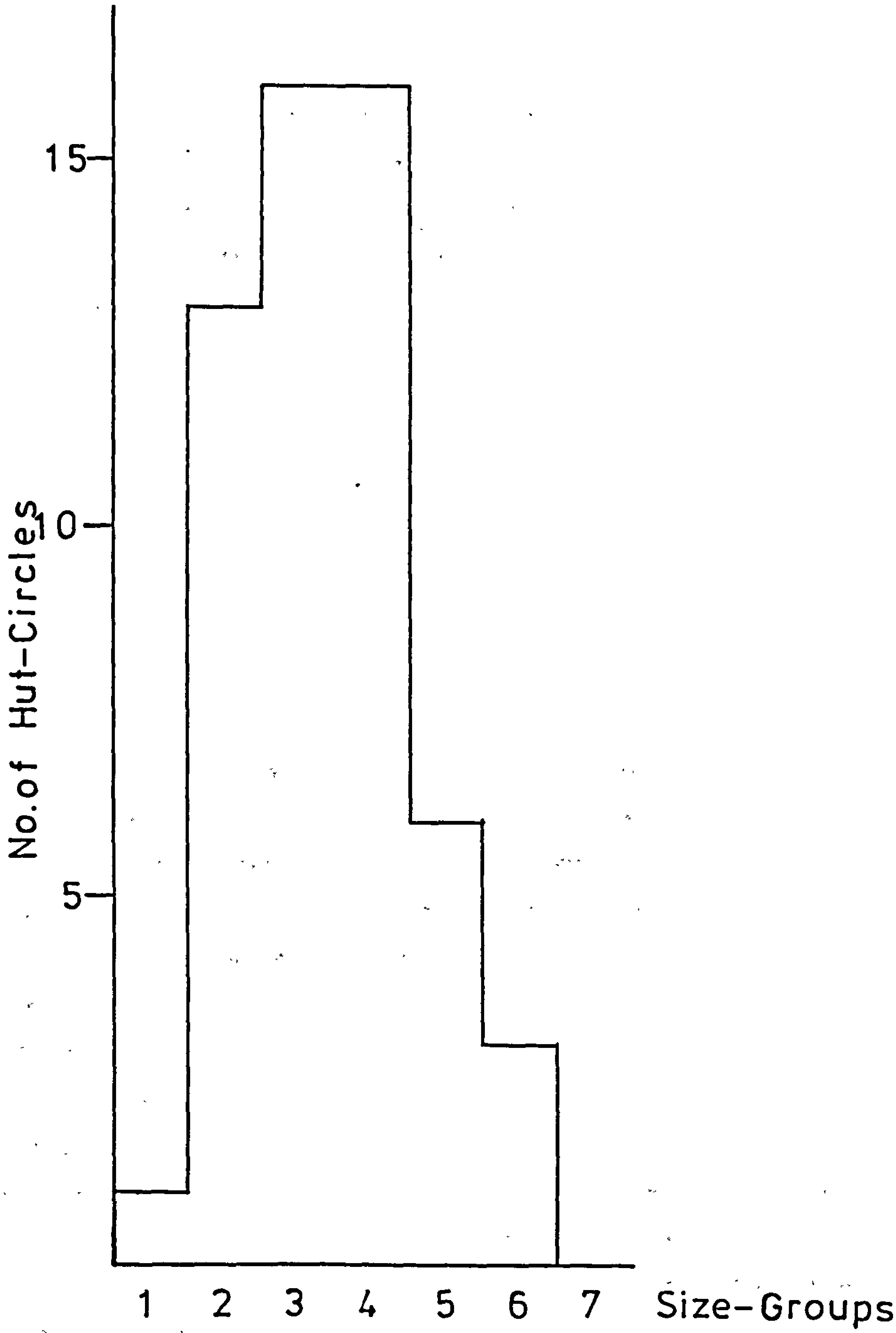


Fig. 2:7 Internal area of hut-circles which are earlier than their enclosures

type was constructed solely of dry-stone masonry, though examples are now mostly reduced to banks of rubble. (1945, 232)

While some hut-circles have been shown to consist entirely of one type of construction, others, as in the case of enclosures, reveal a combination of two or even three types. For example, at Grimspound, the inner faces of hut-circles XVIII and XIX combined an arc of coursed masonry in the NW sectors with faced blocks elsewhere. (Baring-Gould *et al* 1897, 157) Recent excavations provide more detailed descriptions of composite constructions. For example, at enclosure 15 on Shaugh Moor a combination of liners and coursed masonry formed the inner faces of houses 15 and 19. (Wainwright and Smith 1980, 77, 83), while in Site B, House 1 at Holne Moor, the inner face of regular uprights abruptly changed in the NE sector to dry-stone masonry. (Fleming 1979b, 5)

The use of a combination of techniques may be attributed to several factors. Fleming interpreted the abrupt change of building method in House 1 at Site B, Holne Moor, as a gang junction, similar to those observed in enclosures (1979b, 5), though any surprise over the lack of uniformity in an enclosure (see above p. 27) is even more apposite in such a relatively small structure as a hut-circle.

Functional considerations may also have contributed. It is assumed that the purpose of the inner face was to provide as smooth a surface as possible. Thus even where the inner face consisted of an almost continuous series of liners, small dry-stone masonry was required to fill the interstices. It was also probably necessary to build an inner face of uniform height for supporting the roof. Thus the D.E.C. excavation at Mon 226h at Legis Tor and Lady Fox's excavation at Hut 1, Kestor demonstrated that coursed masonry had been piled on top of the inner liners to achieve this. (Baring-Gould *et al* 1896, 188 Hut 10; Fox 1954, 28) Furthermore, R.H. Worth noted that a thicker wall may have been necessary on the uphill side of a hut-circle, situated on a slope, to act as a buttress against natural soil creep, and presumably also as protection from surface water. Thus at Hut 1, Metherel a backing of coursed masonry, turf bank and toe stones was found behind the inner face on the higher side, and even then some inner liners had been caused to collapse into the interior. (1935, 121-122) Conversely, a more substantial wall may have been required on the downhill side to resist slippage of the whole structure downslope; for example, in Hut 1 at Kestor the wall core on the downhill side contained many large boulders, in contrast to the smaller rubble core on the uphill side. (Fox 1954, 28)

Alternatively, differences in technique might be partly explained (as in the case of enclosures) by underlying geology. R.H. Worth's recognition of the reluctance to transport building materials for domestic structures over any distance, has already been noted. (See above p. 51) Thus hut-circles, constructed entirely of small dry-stone masonry, tend to be found where granite slabs do not occur. It may then follow that the converse is true: that hut-circles consisting of the double-orthostatic wall-face occur in areas with an abundance of thin flat slabs, while a combination of a few liners and dry-stone masonry may have resulted when only a limited number of suitable slabs were available in the immediate vicinity.

Examination of the UPV survey evidence suggests that the three main categories of double-faced or single-faced wall or rubble/coursed wall can be recognised in the field without excavation. While some hut-circles seem to have been constructed solely out of one of these methods, many more are composite structures, such as those identified by excavation.

In order to appreciate fully the combinations of techniques, the variations in construction were identified. Thus the inner faces were found to consist of relatively thin flat slabs (liners), large faced blocks or coursed masonry. (Table 2:4, Nos. 2a-c) These three techniques were also recognised in outer faces, as well as revetments of relatively small "toe" stones. (Table 2:4, Nos. 3a-d) Occasionally a single face constitutes the whole wall and can consist of liners or boulders. (Table 2:4, Nos. 1a and b) A large group of structures, which may have originated as coursed walls or simple dumps, survive as walls of large blocks or small rubble or as turf-covered banks. (Table 2:4, Nos. 5a-c) The latter three categories of extant remains are quite distinct but the nature of their original construction is not now distinguishable. Finally the description of structure can also take into account the presence of

Table 2:4 Table of Construction Techniques.

1 =	Single face	a) liners b) boulders
2 =	Inner face	a) liners b) faced blocks c) coursing
3 =	Outer face	a) liners b) faced blocks c) coursing d) toe stones
4 =	Rubble core	
5 =	Rubble dump or turf-covered bank,	a) large irregular blocks b) small rubble c) turf-covered bank
6 =	Groundfast boulder	

( ) = Discontinuous wall-face (whether liners, blocks or coursing).

rubble core (Table 2:4, No. 4) and the incorporation of groundfast boulders (Table 2:4, No. 6).

Thus the structure of each hut-circle can be described according to its component parts. A hut-circle, consisting solely of a double orthostatic wall-face with extant rubble core would be described 2a; 3a; 4. (eg. **Mon 148d**, Fig. 2:10) A hut-circle with liners and traces of coursed masonry on the inner face, and with faced blocks on the outer face would be described: 2a/2c; 3b. However, where combinations of the different types of structure occur, it can be difficult to determine whether this is a result of dilapidation or the original construction. For example, in a hut-circle with only two or three liners on the inner face and irregular stones otherwise (eg **Mon 1179d**, Fig. 2:9), it is not clear if the inner face originally consisted of a continuous series of liners, or if it was composed of the liners and dry-stone masonry, probably originally coursed, visible today. Liners may have been removed for later wall-building or may simply have fallen flat; fallen slabs were frequently found in D.E.C. excavations embedded in the "meat earth" or humic soil in the hut-circle interiors, such as at Grimspound. (Baring-Gould *et al* 1894, 105-6) Even in hut-circles constructed in a single technique, the extant remains may not reflect the original structure. For example, Nos. 1a and b were probably originally backed by turf banks, which have since eroded. (eg. Fig 2:8) However, in such cases, the original construction is purely a matter for conjecture, and, therefore, any analysis must concentrate on the present condition of the hut-circles. The descriptive notation can take this into account; thus structures, which do not have a continuous wall-face are put in parentheses. For example, **Mon 1179d**, noted above, would be described (2a); 4.

The details of structure of 407 hut-circles in UPV were described in this way. (See Appendix A)

FN 1 This total includes three structures, which have been interpreted only tentatively as prehistoric hut-circles (**Mons 173c, 349h** and **1034b**) but omits nine structures, which were too badly damaged to be identified (**Mons 156e** NW and SE, **714, 778, 783, 784, 1042d, 1078g** and **1173e**) and three structures, which were not drawn at a large scale (**Mons 40, 358c** and **454**).

However, in order to produce a useful classification, the numerous permutations of construction techniques had to be arranged into groups. While efforts were made to maximize the objectivity of the descriptions of structure, it is argued that the classification should be more interpretative; that is, it should reflect significant building techniques, which may coincide with particular functional requirements.

Thus some of the distinctions recorded in the descriptions may not have been particularly significant to the builder. For example, liners and faced blocks presumably served the same purpose in providing a smooth surface and, therefore, should not be divided into separate classes. Furthermore, it may be misleading to distinguish between extant coursed masonry and tumbled rubble. Relatively few examples of coursed stonework have been recorded in UPV, but the overgrown small irregular stones often marking wall-edges between occasional faced blocks or liners, were probably also originally part of coursed walls. Excavation might reveal more traces of coursed masonry (eg. the D.E.C. excavations at Legis Tor) though coursing may often have collapsed.

Analysis of the descriptions of structure suggests that the UPV hut-circles can be divided into four major groups, on the basis of structural distinctions, possibly corresponding to a particular function, or simply the availability of building materials. (See Table 2:5) Group I consists of hut-circles, which survive simply as a single row of stones, without any stone rubble or earthen bank, though they may originally have had a significant turf or timber component. These are distinguished from a relatively small group of hut-circles, Group II, consisting of an inner face, backed by stone rubble. The hut-circles in Group III have traces, to a varying extent, of an inner and outer face, and are usually accompanied by rubble core. Finally, Group IV consists of hut-circles, which may originally have been constructed of a simple dump, or of coursed masonry, which is now reduced to a dump of rubble or a turf-covered bank.

These four groups can be sub-divided, again based on structural criteria. (see Table 2:5) Sub-groups in Groups I and IV are distinguished according to the nature of their stone content. Thus a distinction may be made in Group I between hut-circles constructed of flat slabs or

Table 2;5 Classification of Structure.

GROUP	DESCRIPTION		TYPE	% OF TOTAL	FIG.
I	Single Face :	Liners	A	3,93%	2;8
		Boulders	B	9.09%	2:8
III	Inner Face :	Continuous	C	0,98%	2;9
		Discontinuous : Arcs	D	2,46%	2;9
		Intermittent	E	7.37%	2:9
III	Double Face :	Continuous Inner and Outer	F	5,65%	2;10
		Continuous Inner/Discontinuous Outer	G	2,46%	2;10
		Continuous Outer/Discontinuous Inner	H	0,25%	2;10
		Discontinuous : Outer and Inner Arcs	I	3,44%	2;11
		Outer Arc	J	2,70%	2;11
		Inner Arc	K	5,65%	2;11
		Outer and Inner Intermittent	L	18.92%	2:12
IV	Dump/Coursed Masonry :	large irregular stones	M	4,42%	2;13
		small rubble	N	10,57%	2;13
		turf-covered banks	O	22.11%	2:14

liners (Type A; Fig. 2:8) and those of irregular boulders (Type B; Fig. 2:8). Similarly, Group IV can be divided into hut-circles, constructed of large irregular stones (Type M; Fig. 2:13), small rubble (Type N; Fig. 2:13) or turf-covered banks (Type O; Fig. 2:14). In this group, sub-division is based on the present condition of the monuments but the distinction between Types N and O may not reflect their original construction. Both types may have originated as dump walls or coursed masonry. However, in the absence of excavation, the structure, particularly of turf-covered banks cannot be accurately identified and therefore these hut-circles are isolated as separate types.

In the sub-division of Groups II and III, the distinction between a faced surface (ie. a wall-face edged with liners or faced blocks) and coursed masonry was considered to be the most significant criterion as this may reflect building preference or local availability of materials. The distinctions between liners and faced blocks and between extant coursed masonry and small irregular stones were considered to be less significant for reasons outlined above. Thus the two groups were divided into hut-circles with more or less continuous faced surfaces (Types C, F, G and H; Figs. 2:9 and 2:10) and those with discontinuous faced surfaces (Types D, E, I, J, K and L; Figs. 2:9, 2:11 and 2:12). A further sub-division of the discontinuous groups may well reflect building technique; thus hut-circles, in which the visible faced stones are arranged in arcs (Types D, I, J and K) may be distinguished from those, in which the visible faced stones are arranged singly at intervals around the perimeter (Types E and L). In the former, coursed masonry may have been constructed in an arc to complete a circuit of faced stones, as at Grimspound XVIII and XIX, while in the latter, it may have filled gaps between intermittent faced stones. (Baring-Gould *et al* 1894, Fig. opp. 114)

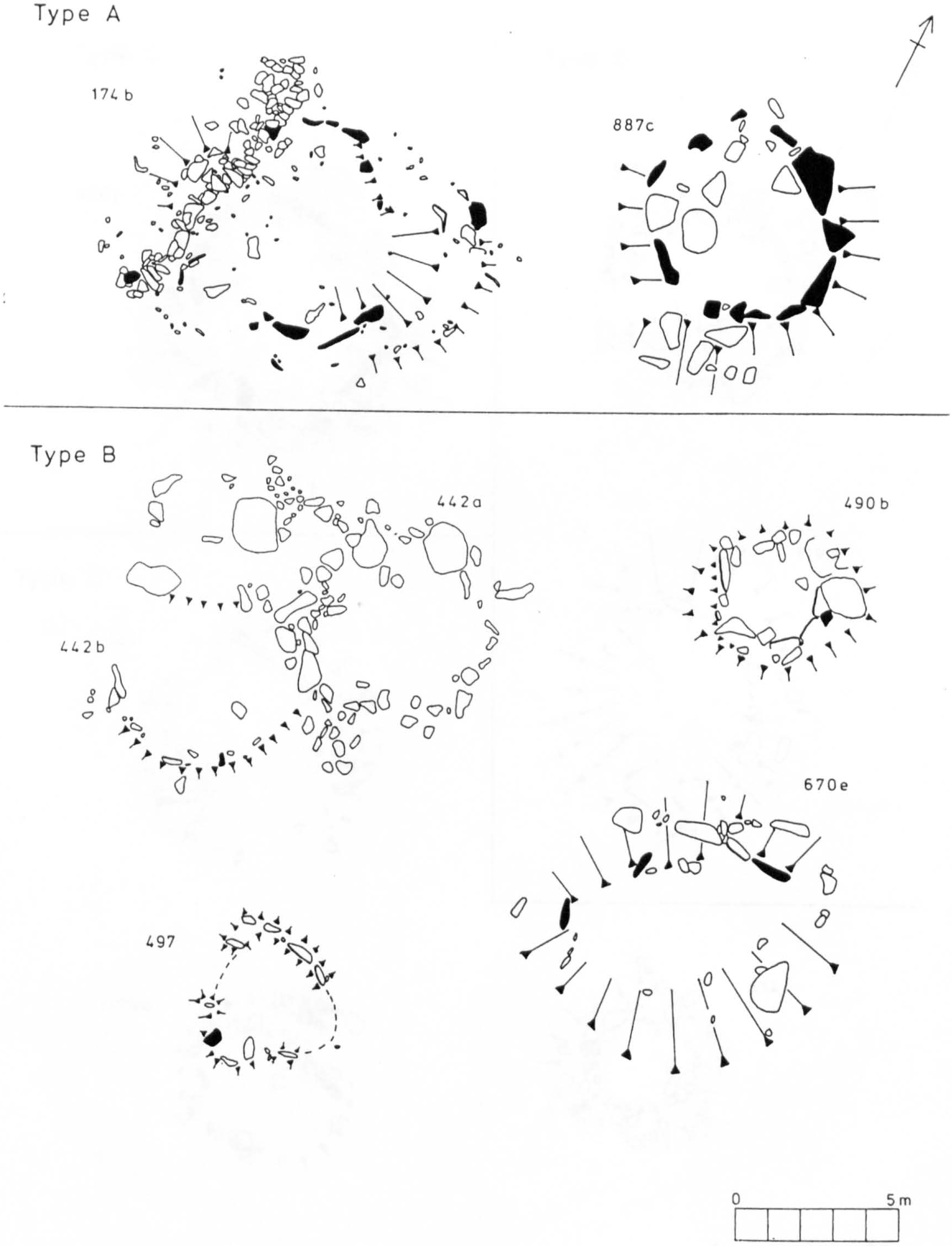


Fig. 2:8 Hut-circles in UPV : structure types A and B

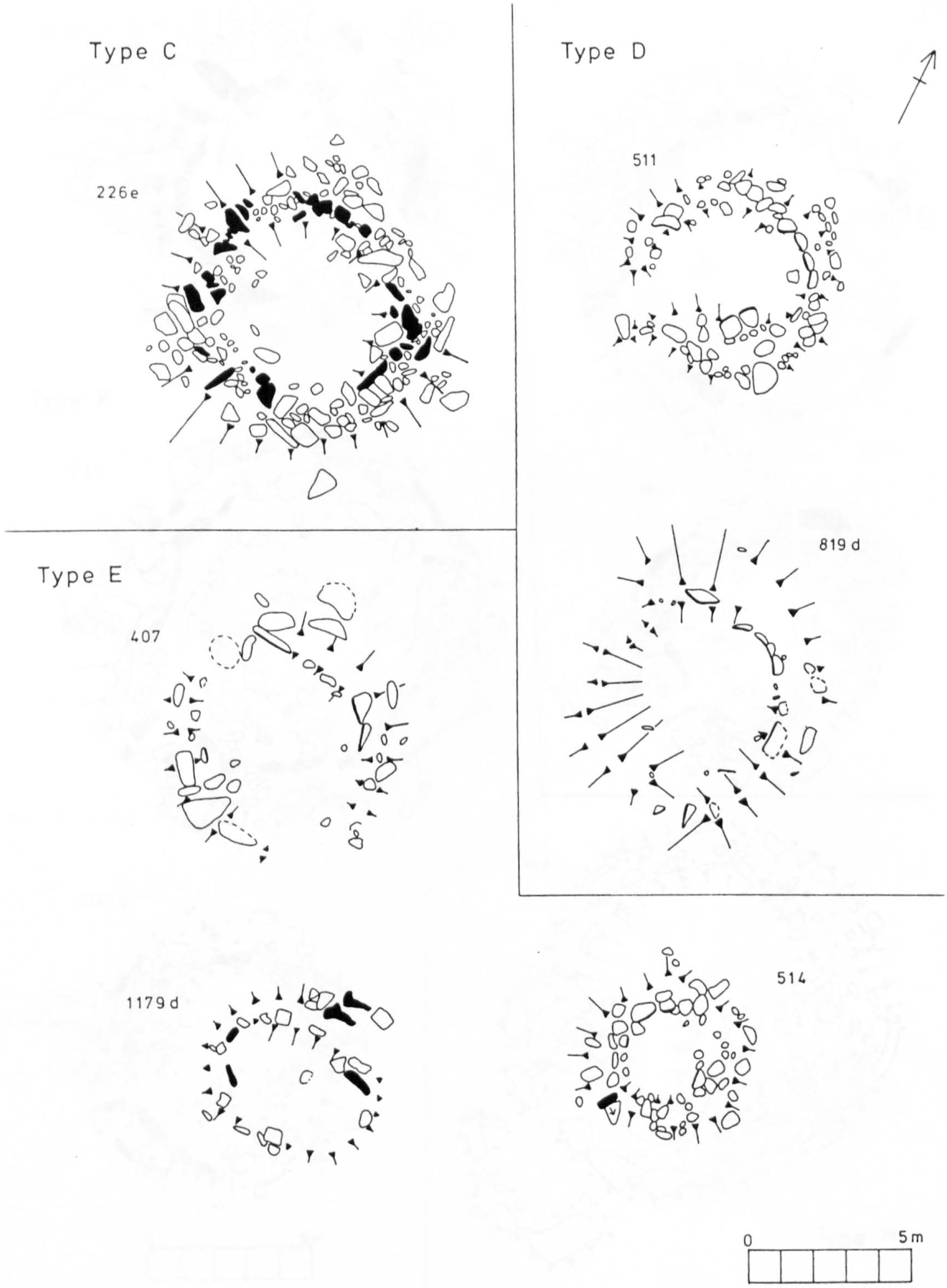


Fig. 2:9 Hut-circles in UPV :
structure types C, D and E

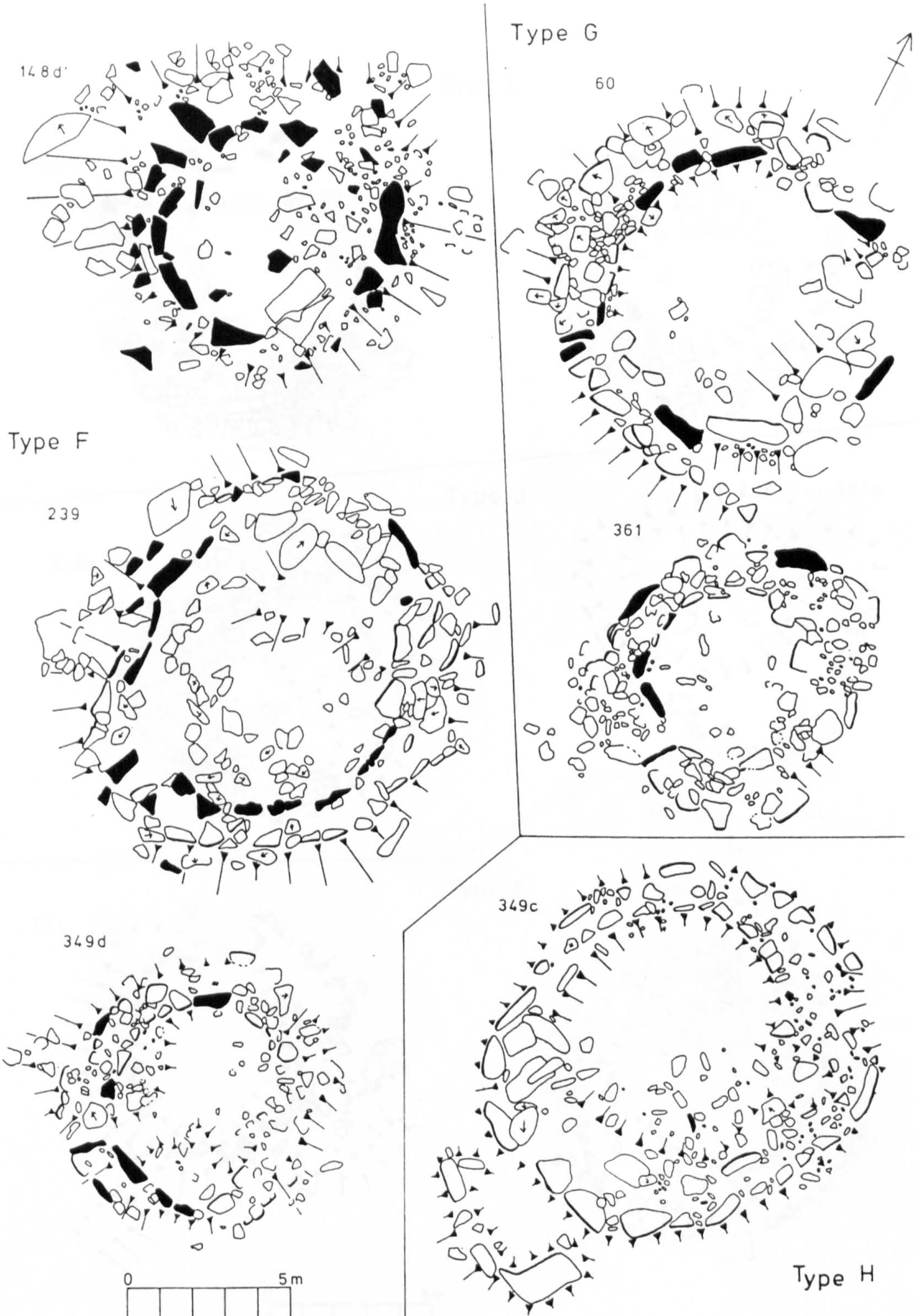


Fig. 2:10 Hut-circles in UPV :
structure types F, G, and H

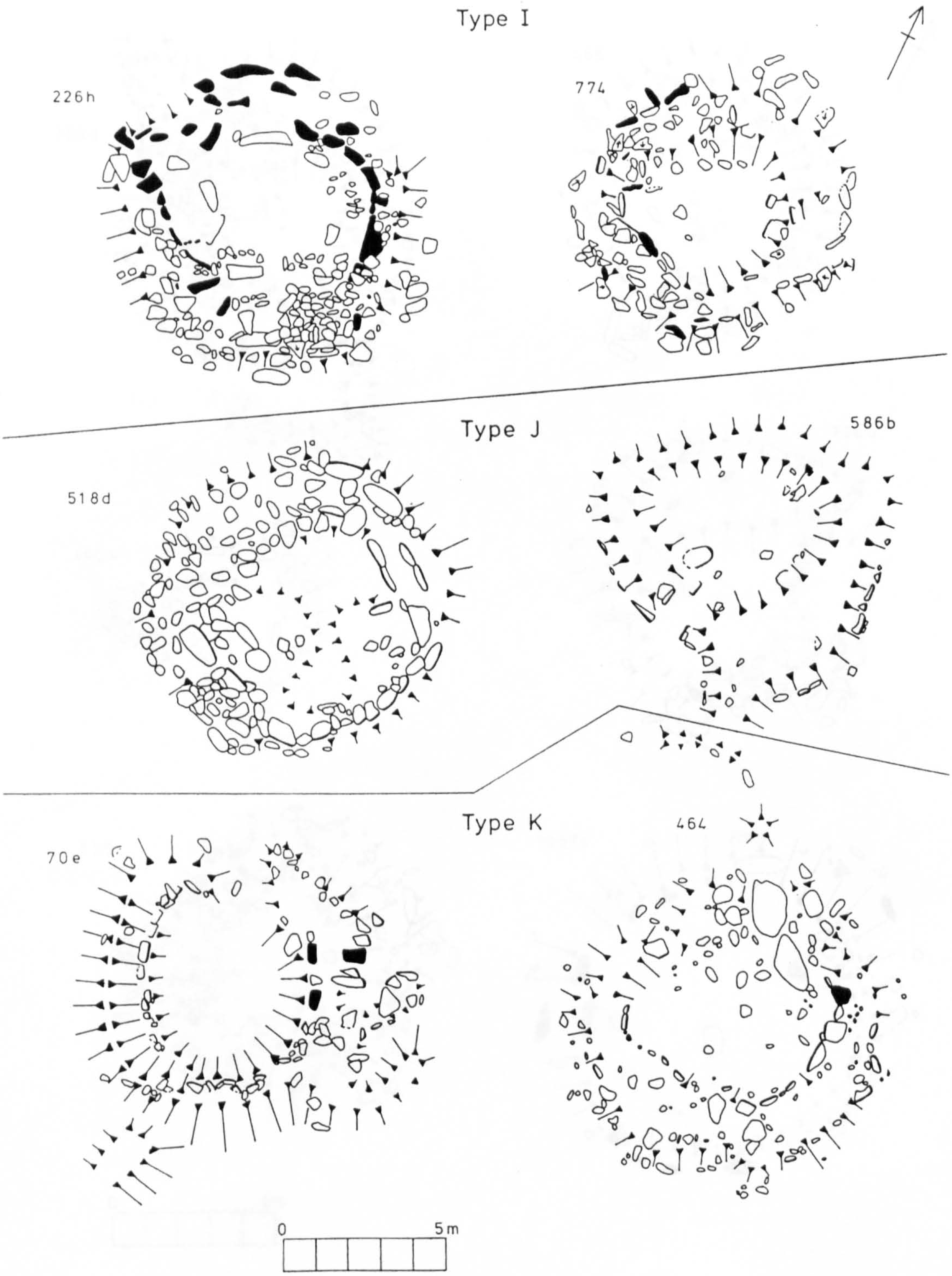


Fig. 2:11 Hut-circles in UPV :
structure types I, J, and K

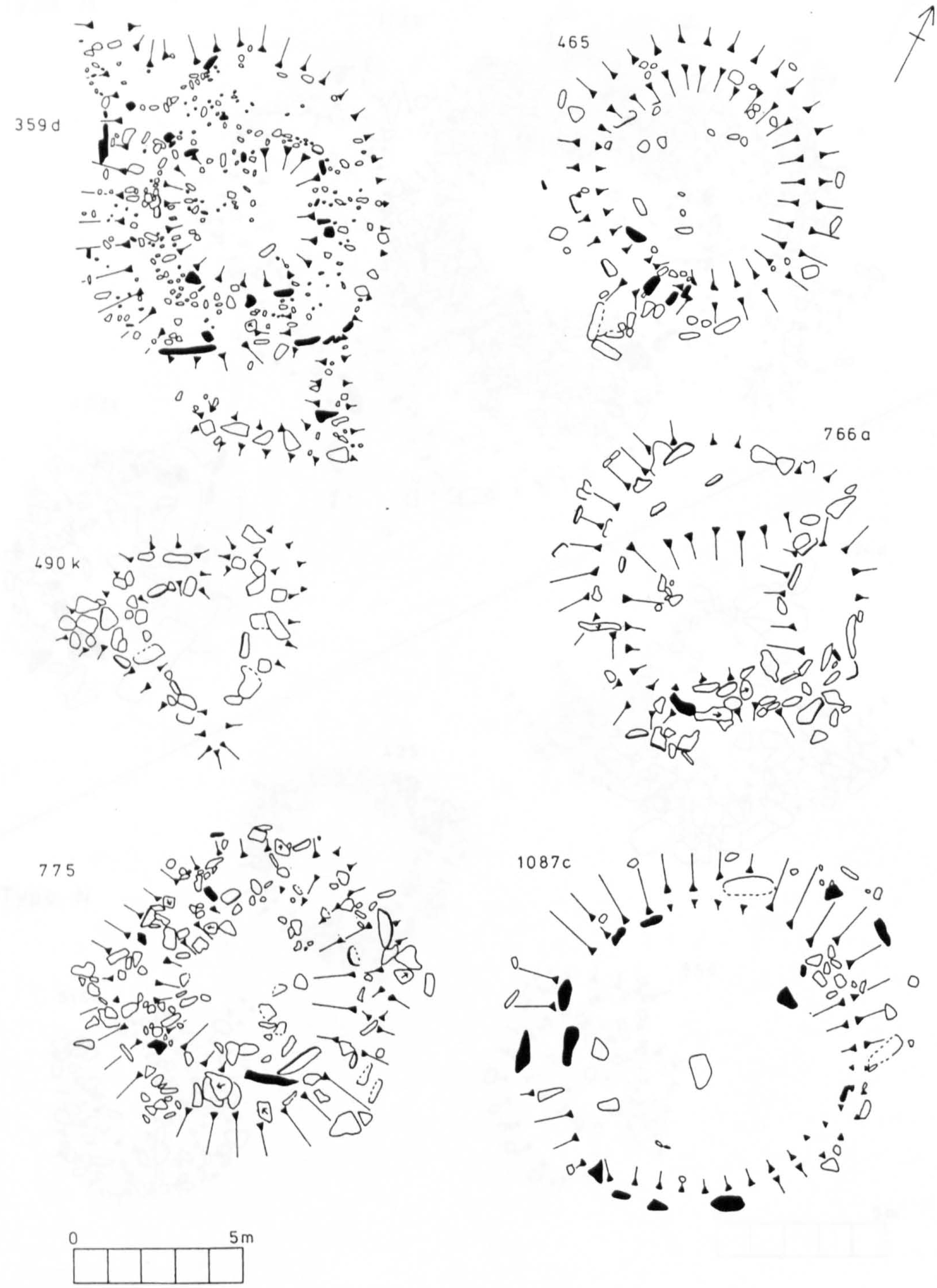


Fig. 2:12 Hut-circles in UPV :
structure type L

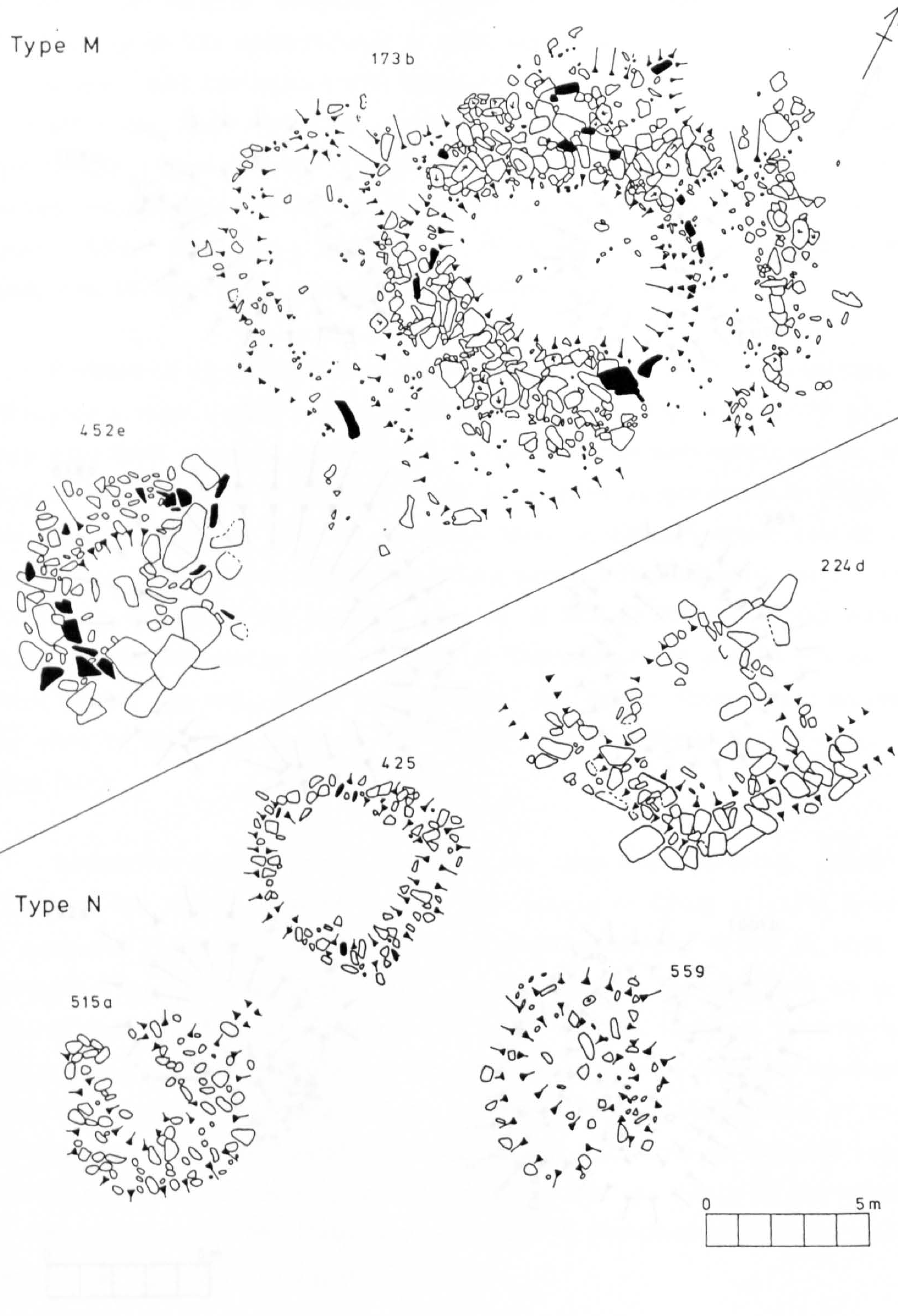


Fig. 2:13 Hut-circles in UPV :
structure types M and N

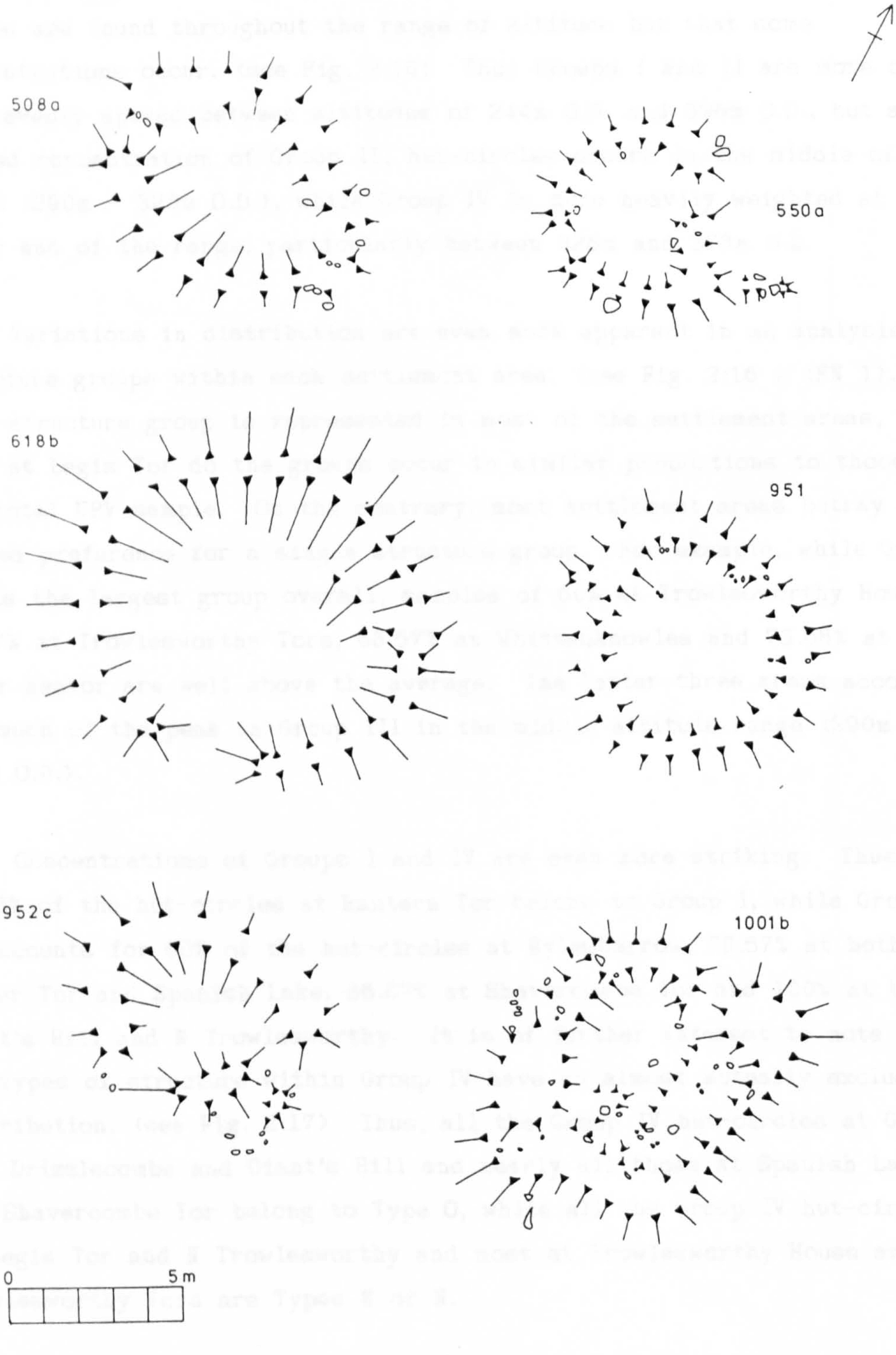


Fig. 2:14 Hut-circles in UPV : structure type O

f) <u>The Distribution of Types of Structure</u>

Analysis of the classification reveals that Groups III and IV are the most numerous, containing 39.07% and 37.10% respectively of the total number of hut-circles, compared to 13.02% in Group I and 10.81% in group II. A study of the distribution of the four groups shows that all four groups are found throughout the range of altitude but that some concentrations occur. (see Fig. 2:15) Thus Groups I and II are more or less evenly spread between altitudes of 244m O.D. and 396m O.D., but a marked concentration of Group III hut-circles occurs in the middle of the range (290m - 328m O.D.), while Group IV is more heavily weighted at the upper end of the range, particularly between 328m and 373m O.D.

Variations in distribution are even more apparent in an analysis of structure groups within each settlement area. (see Fig. 2:16) (FN 1). Each structure group is represented in most of the settlement areas, but only at Legis Tor do the groups occur in similar proportions to those of the total UPV sample. On the contrary, most settlement areas betray a marked preference for a single structure group. For example, while Group III is the largest group overall, samples of 60% at Trowlesworthy House, 61.67% at Trowlesworthy Tors, 68.57% at Whittenknowles and 73.68% at Lower Hentor are well above the average. The latter three areas account for much of the peak in Group III in the middle altitude range (290m - 328m O.D.).

Concentrations of Groups I and IV are even more striking. Thus 71.43% of the hut-circles at Eastern Tor belong to Group I, while Group IV accounts for 60% of the hut-circles at Eylesbarrow, 78.57% at both Gutter Tor and Spanish Lake, 86.67% at Shavercombe Tor and 100% at both Giant's Hill and N Trowlesworthy. It is of further interest to note that the types of structure within Group IV have an almost mutually exclusive distribution. (see Fig. 2:17) Thus, all the Group IV hut-circles at Gutter Tor, Drizzlecombe and Giant's Hill and nearly all those at Spanish Lake and Shavercombe Tor belong to Type O, while all the Group IV hut-circles at Legis Tor and N Trowlesworthy and most at Trowlesworthy House and Trowlesworthy Tors are Types M or N.

FN 1 Settlement areas, containing less than five hut-circles were considered to be too small for comparitive purposes and, therefore, Lower Hartor Tor, Crane Lake, Upper Langcombe and Lower Langcombe were omitted.

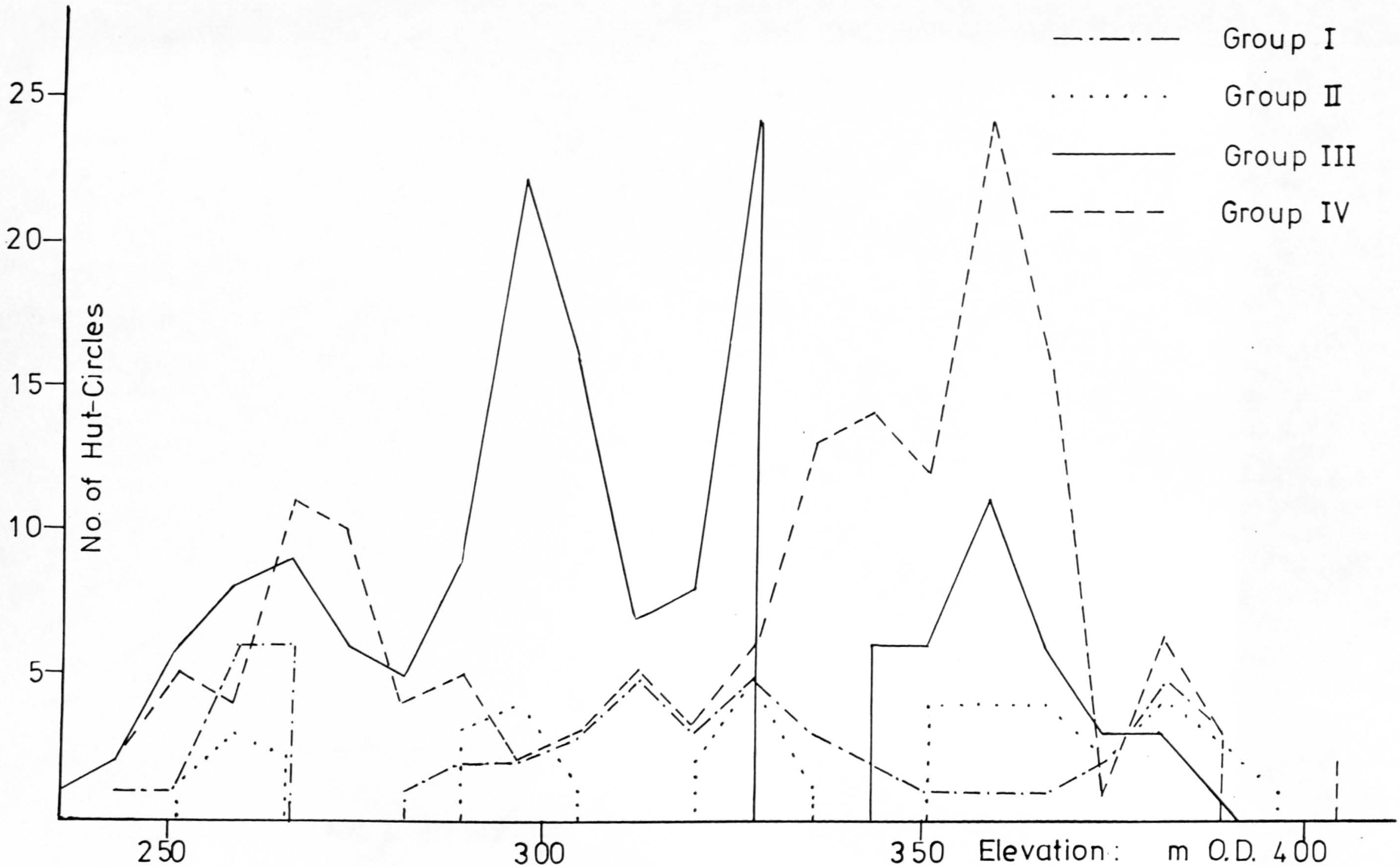


Fig. 2:15 The distribution of structure-groups according to altitude

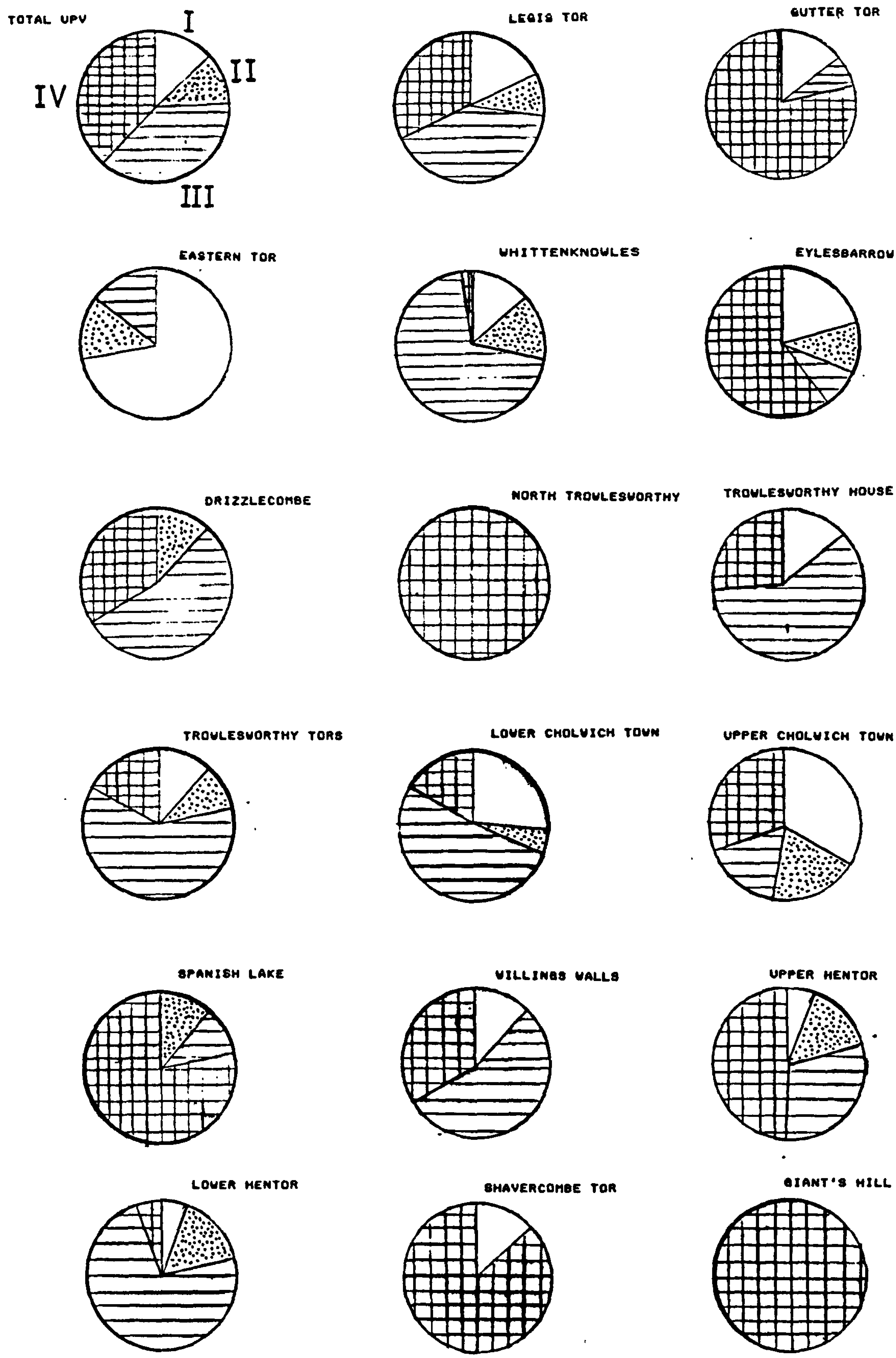


Fig. 2:16 The distribution of structure-groups I-IV within settlement areas

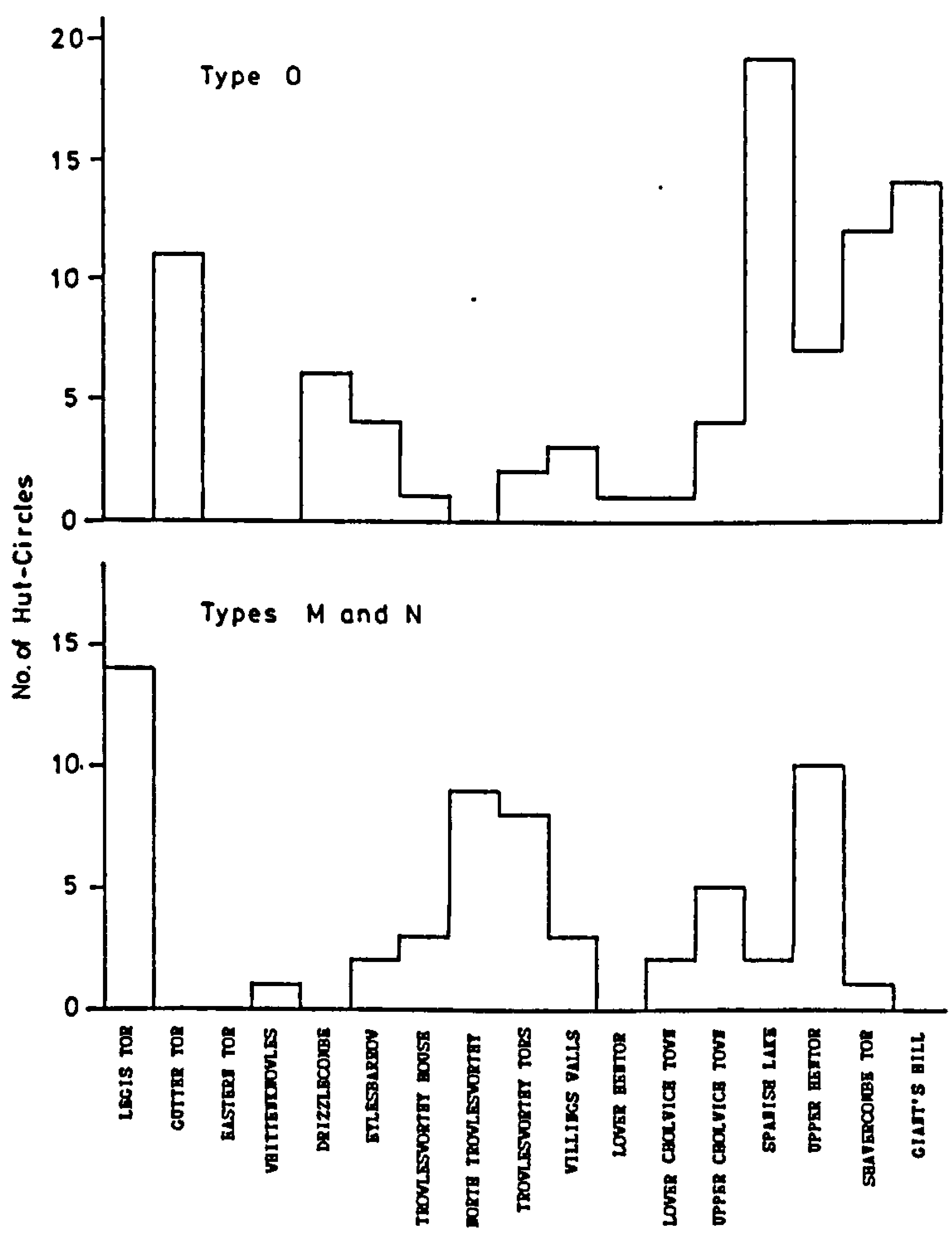


Fig. 2:17 The mutually-exclusive distribution of structure-types M/N and O

It may be significant that the concentrations of Type O dump or coursed wall structures mostly occur on the metamorphic zone, where large slabs, suitable for other types of structure are absent, for example, at the Gutter Tor settlement area on the N bank of the R Plym, as well as at Shavercombe Tor and Giant's Hill above the reave on the S bank. This may, therefore, confirm the suggestion noted above that the type of structure can depend on the availability of materials.

However it is also tempting to equate these preferences for particular types of structure in certain areas with particular economic or social activities. The contrasting distribution of structure-groups is even more striking if the S bank is considered in isolation. Thus the settlement areas, in which structure-group III predominates, are all situated below the Willings Walls/Cholwich Town contour reave, while structure-group IV is concentrated above the reave. (See Fig. 2:16) The North Trowlesworthy settlement, below the reave but with 100% structure-group IV hut-circles, is the sole exception but may refect Medieval/Post-Medieval interference. The distribution is best illustrated by contrasting the assemblages at settlement areas in the same interfluves but below and above the reave, notably between Lower Cholwich Town and Upper Cholwich Town, between Willings Walls and Spanish Lake and between Lower Hentor and Upper Hentor. (See Fig. 2:16)

This probably corresponds to O'Neill's discovery (1983, 172), in an analysis of wall widths, that the hut-circles below the reave had significantly thicker walls and were presumably more sturdily built than the hut-circles above the reave, supporting the proposition that the hut-circles below the reave were designed for permanent occupation in contrast to seasonal occupation above the reave.

g) <u>The relationship between Size and Structure.</u>

The possibility that structure varies according to size must also be considered. The percentage of hut-circles occurring in each of the seven size-groups has been calculated for each of the four structure-groups and is plotted in Fig 2:18.

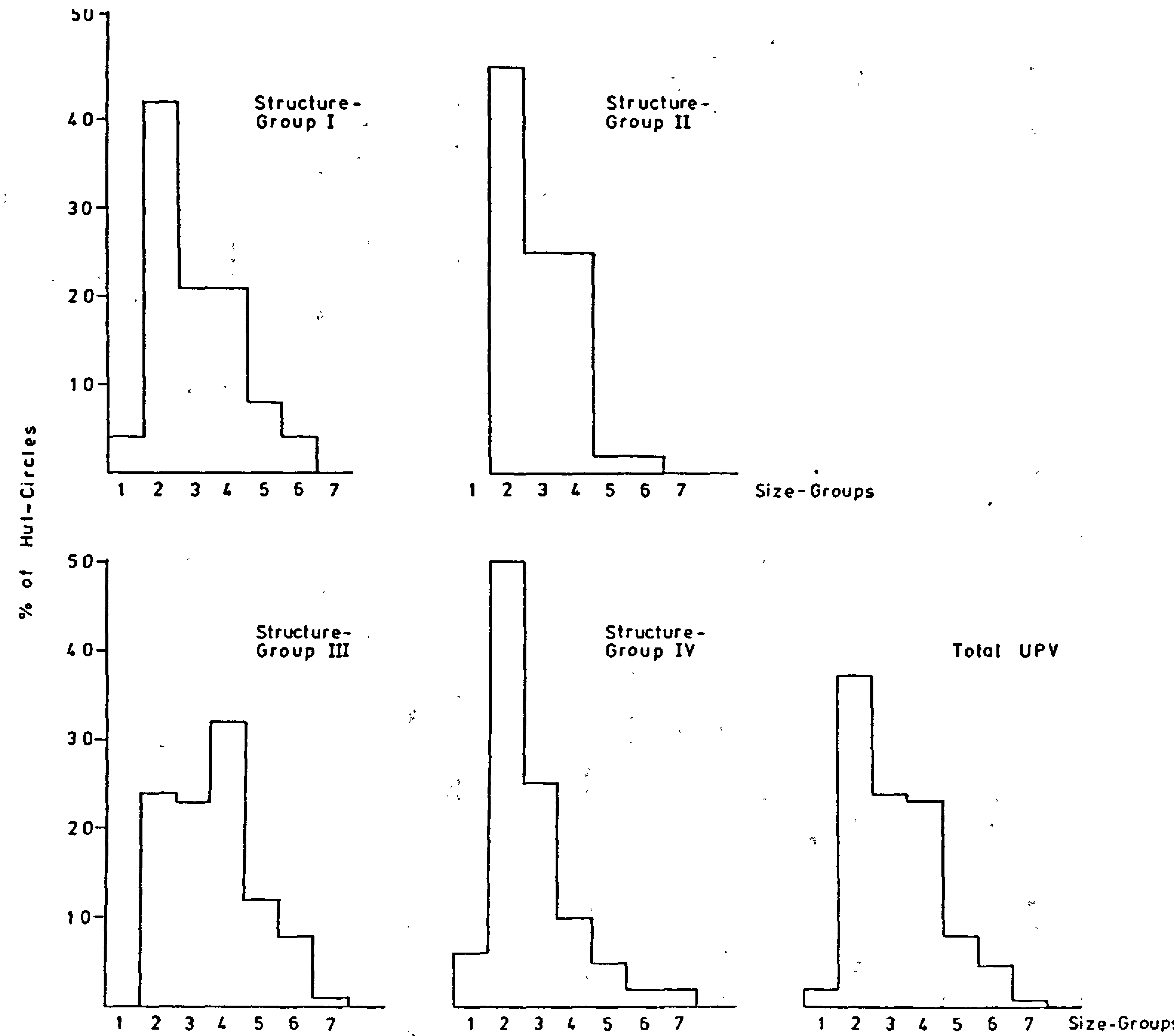


Fig. 2:18 The relationship between size and structure

This demonstrates that the distribution curve in structure-groups I, II and IV, with a preponderance in the smaller size-groups, particularly size-group 2 ($4m^2$ - $11m^2$) reflects the overall distribution of sizes within the whole assemblage. This contrasts with structure-group III, which is more heavily represented in the larger size-groups with the highest percentage in size-group 4 ($20m^2$ - $29m^2$). This may suggest a correlation between larger, or at least medium-sized, hut-circles and the double-faced type of structure, a relationship earlier identifed by Radford. (1952, 60)

The correlation between size and structure within each settlement area may also be considered. Many of the settlement areas have too few hut-circles or too narrow a range of structure types for any significant conclusions to be drawn. However, interesting comparisons can be made between four areas with large numbers of hut-circles, containing all the different structure-groups. (See Fig. 2:19) Thus a clear distinction can be made between the assemblages at Trowlesworthy Tors and, particularly Legis Tor, where the four structure-groups are relatively evenly-spread throughout the seven size-groups and the assemblages at Upper Cholwich Town and Upper Hentor, where the four structure-groups are concentrated in a single size-group. This suggests that, at the latter sites, significantly located above the contour reave, size was a more important criterion in hut-circle construction than structure.

h) <u>The relationship between Structure and Relative Chronology</u>

It is further possible that structure varies according to relative chronology. Thus out of a sample of 60 hut-circles, which are earlier than their enclosures, 53.33% are in structure-group III, almost exclusively in the "discontinuous face" categories, particularly Type L. 38.33% are in structure-group IV but only 3.33% and 5% are in structure-groups I and II respectively. By contrast, out of 51 hut-circles, which are later than or contemporary with their enclosures, structure-group IV predominates with 52.94% of the sample. Thus the use of dump (or coursed) walls for later constructions, noted earlier among enclosures, such as Mons 227a and 229 at Legis Tor, is repeated among the hut-circles. Structure-group III is still well-represented with 25.94% but structure-group I, with 17.65%, is rather more popular than in the "early" sample.

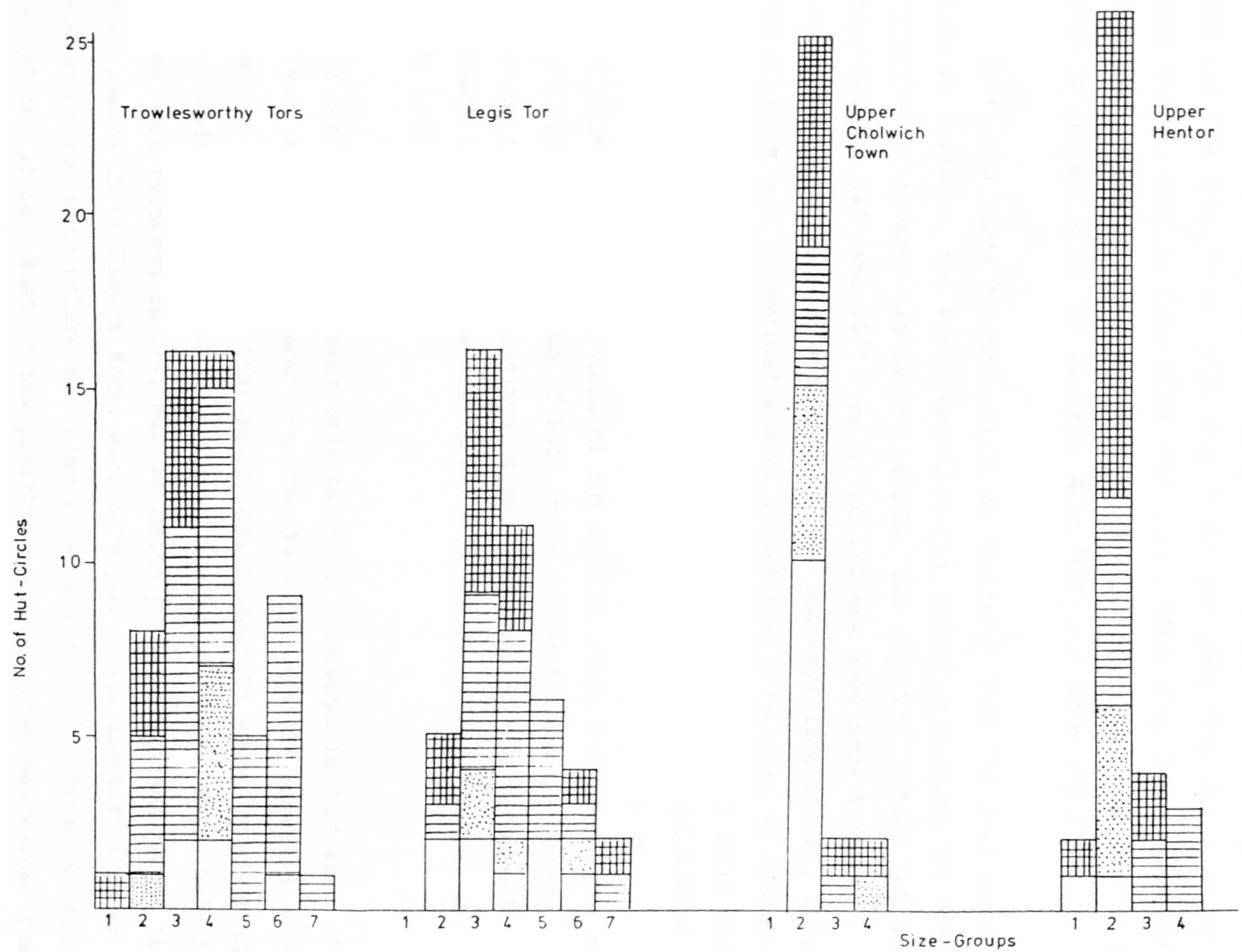


Fig. 2:19 The relationship between size and structure in four settlement areas

i) Entrances

Entrances have been identified, though many only tentatively, in 211 of the hut-circles. Many are recognizable only as a simple gap through the wall, such as **Mons 490k** (Fig. 2:12), **511** (Fig. 2:9). **515a** and **559** (Fig. 2:13) and **618b** (Fig. 2:10). However, some are more clearly defined and flanked by orthostats, for example, **Mons 245** and **517i** (Fig. 2:20), **60, 148d** and **239** (Fig. 2:10), **173b** (Fig. 2:13) and **226h** (Fig. 2:11), or by faced blocks, such as **Mons 823b** (Fig. 2:20), **586b** (Fig. 2:11) and **819d** (Fig. 2:9). Others are marked by a thickening of the wall on one or both sides of the entrance, for example, **Mons 517i** and **823b** (Fig.2:20)

Entrances might be expected to be sheltered from the most severe winds on Dartmoor, the Northwesterlies and, indeed, the doors are oriented predominantly towards the SW, S and SSE. (See Fig. 2:21) Thus 69% are found between 140° and 240° from N and 42% are even more tightly concentrated between 170° and 220°. A few doorways face the NW, though most of these are ill-defined and only tentatively included as entrances. Significantly, the few, which are more certain entrances, all occur above the contour reave. (**Mons 492, 515a, 517g, 517i, 518c, 555m** and **1000e**) In a statistical test, O'Neill found that, "at about the 3% level of significance", door orientations of hut-circles above the reave were more widely-dispersed than those of hut-circles below the reave, thereby supporting the proposed distinction between seasonal and permanent settlement above and below the reave. (Fieller and O'Neill quoted in O'Neill 1983, 178)

In finding that the mean orientation of doorways is 8.2° West of South and thus less sheltered from the NW than might be expected, O'Neill pointed out (1983, 178-9) that additional protection would be given by porches swinging eastwards from the W side of the door. Relatively few porches were recorded in UPV, but, as Smith points out (1982, 241), those at enclosure 15 on Shaugh Moor, were only positively identified after excavation and many others may simply be unrecognizable from surface indications alone. Most of the positive examples curve eastwards from the right-hand side of the door, as O'Neill suggests, such as **Mons 56c, 490j** (Fig. 2:20) and **349c** (Fig. 2:10). A few porches curve round both sides of the entrance, forming a circular ante-room, such as **Mons 446a** and **b** (Fig. 2:20) and **769a-c** and a few also swing in the opposite

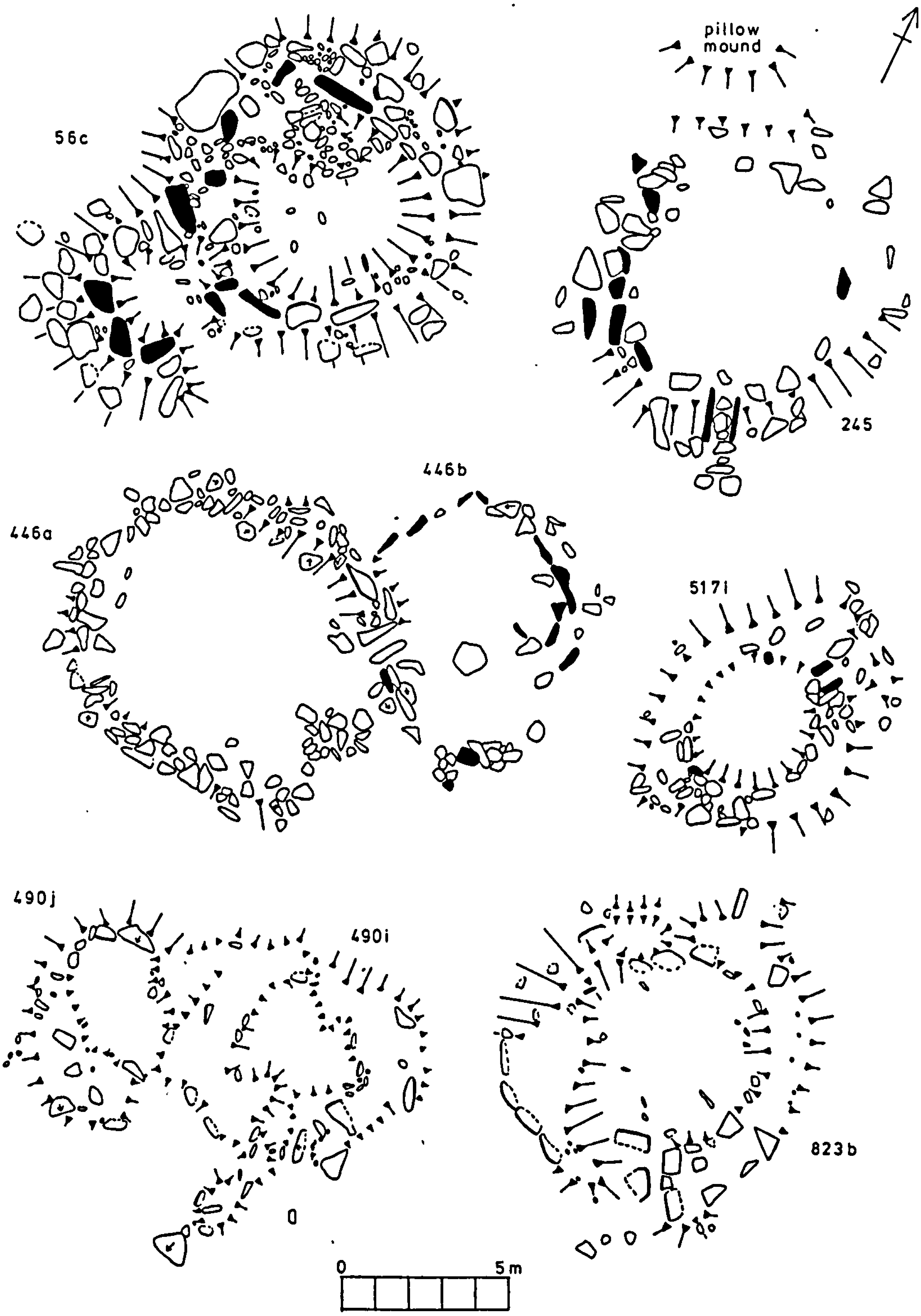


Fig. 2:20 Hut-circles in UPV : entrances

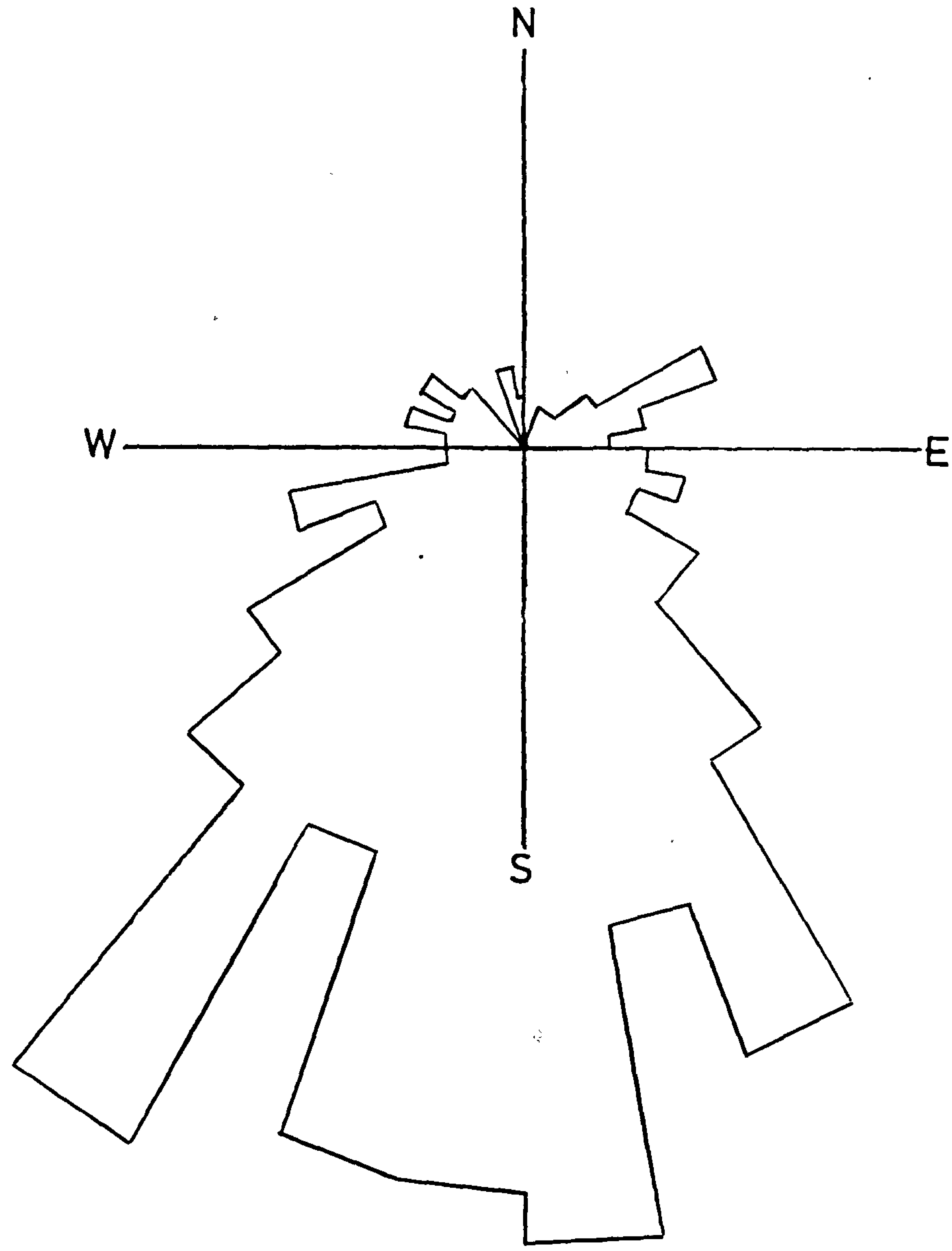


Fig. 2:21 The orientation of doorways

direction from the left-hand side of the door, such as **Mons 359d** (Fig. 2:12), **55** and **490n**. Finally, a platform, possibly paved, seems to have been built up around some entrances, for example at **Mons 171, 225e** and **760**.

j) The Significance of Enclosure

It has already been suggested that the differences in location, size and structure of hut-circles, outlined above, may reflect differences in economic practices. Another distinction that can be made is whether a hut-circle is enclosed or not, though as many, if not most, of the hut-circles were built in a pre-enclosure phase and only subsequently enclosed or deliberately left unenclosed, the act of enclosure may not be relevant to a comparison of size and structure of hut-circles. These characteristics would have been determined by the conditions or requirements of the pre-enclosure phase.

Nevertheless, enclosures may have been laid out according to particular criteria. The contrast, already noted, between enclosures with centrally-located hut-circles and those with hut-circles arranged around the perimeter, may have been designed to suit particular economic activites. However, it should be remembered that the "enclosure phase" may span a considerable period of time, within which criteria may have changed. Thus contrasting layout could alternatively reflect changing environment or simply changing fashion. For example, when Phase I of the Legis Tor enclosure complex was enclosed, a large clear interior may have been required and the hut-circles in **Mon 224a** are all located on the perimeter. In the succeeding phases, this may not have been necessary and the hut-circles in enclosures **Mons 225a** and **226a** are centrally-located.

Smith recorded evidence of changing criteria within the lifespan of individual enclosures and hut-circles. (1982, 343) Thus, again at Legis Tor, the hut-circle, **Mon 223a** was carefully avoided and left unenclosed by the enclosure wall, **Mon 225a**. However subsequently, criteria may have changed and the hut-circle was joined to the outer face of the enclosure wall by short walls.

The entrances of some hut-circles are directed outside their enclosure. It might be argued that the hut-circle was then out of use and simply incorporated in the wall as a useful structure. However in one example, the entrance must have been in use and may therefore have served some particular function. The hut-circle **Mon 358b** was enclosed, with entrance facing externally, by enclosure **Mon 358a**. Later an annexe, **Mon 359a** was added to the enclosure and clearly changes direction to avoid blocking the entrance and also to avoid enclosing **Mon 358b**, and thereby maintaining its external entrance.

Furthermore, particularly large and well-built hut-circles may have been deliberately enclosed to serve, possibly, a social function. Thus several enclosures have one or two significantly larger hut-circles of the well-built "double face" type of construction (structure-group III). For example, hut-circles, **Mons 71c, 174c, 224c, 225e, 469h** and **1087c** all belong to structure-group III and size-groups 6 or 7 ($40m^2$ - $69m^2$). **Mon 376d** is equally large (size-group 6) but of "inner face" construction (structure-group II), though may still be classed as a well-built structure. Other enclosures, such as **Mons 12a, 56a, 148a, 150, 249a, 358a-359a, 490a, 518a, 747a, 585a-592, 885a-888a** and **1050a** and **b**, also include one or two hut-circles, usually structure-group III and not as large as size-groups 6 or 7 but larger than the remaining structures within the enclosure. All these might be interpreted as the principal house within the enclosure.

The location of these hut-circles within their enclosures simply reflects that of the other structures in the enclosures and may not be particularly significant. For example, **Mon 376d** is situated in the centre of an enclosure of centrally-located hut-circles, while **Mon 224c**, is situated on the wall of an enclosure with peripheral structures.

2.3 DISCUSSION OF THE ARCHAEOLOGICAL EVIDENCE IN RELATION TO CURRENT MODELS OF PREHISTORIC SETTLEMENT ON DARTMOOR

2.3.1 Introduction

It may now be wondered how this evidence fits into current models of prehistoric economy and society and, further, if it can elaborate on them. It is clear, firstly, that the pattern of reaves in UPV provides an excellent example of the large-scale tripartite division of land, imposed on Bronze Age Dartmoor, according to the model proposed by Andrew Fleming. (1978, 1979a, 1983, 1984, 1987, 1988). The Plym Valley is indeed virtually the only valley on Dartmoor which fulfils all the requirements of this model and was fundamental to its formulation.

The significance of this tripartite division may now be considered and particularly its relationship to economy and society and the implications for the settlement evidence in UPV. Discussion of economic significance will focus on two aspects; the distinction between the parallel systems and the open moorland and the distinction within the open moorland between the upland and valley zones. The relationship between the ceremonial and burial sites in UPV and the pattern of land division in the valley will be assessed and finally possible reasons for the pre-eminence of the Upper Plym Valley in settlement evidence and land-division will be considered.

2.3.2 The distinction between the parallel systems and open moorland

It was noted above that the sub-division of territories corresponds to differential land use. A contrast in economy between different sites on Dartmoor had already been identified by Lady Fox on the basis of settlement evidence. (1964, 86-96) Thus she argued that the settlements were broadly contemporary but that houses associated with enclosures were predominantly (though not necessarily exclusively) pastoral while houses associated with rectilinear fields were predominantly (though again not necessarily exclusively) arable. She argued that this distinction corresponds to an E-W divide on Dartmoor, and the apparent concentration of rectilinear fields, now recognised as parallel reave systems, in eastern Dartmoor was attributed primarily to the lower rainfall, prevalent today in this "rain-shadow" area. (*op. cit.*, 93)

The E-W division is now over-ruled by Fleming's model of territories laid out radially around the periphery of Dartmoor, each displaying a parallel reave system and an upland grazing zone. However, Fox's suggestion of contemporaneity between enclosures and parallel systems is still valid and is supported by recent, though limited, C^{14} dating evidence. Thus, as Fleming points out (1983, 196-7) C^{14} dates for banks underlying the Saddlesborough Reave on Shaugh Moor and a reave in the Dartmeet parallel system on Holne Moor, overlap at *c.* 1310 bc. (Smith *et al* 1981, 269; Fleming 1983, 196) These boundaries may be considered to be broadly contemporary with the occupation of enclosure 15 on Shaugh Moor, in the moorland zone above Saddlesborough Reave. Here, the hut-circles, which may have been occupied from as early as 1480 bc $\pm$ 90, were enclosed in 1210 bc $\pm$ 70. (Wainwright and Smith 1980, 119)

Fox's contrast between the economies of parallel systems and enclosures is also followed in recent models, though no longer based on a clear distinction between arable and pastoral farming. Identification of the economy of individual sites is hampered by the non-survival of bones in the acid Dartmoor soils. However recent environmental investigations particularly those accompanying excavations on Shaugh Moor and Holne Moor, show what can be achieved.

Firstly it is clear that there is no overwhelming evidence for arable farming in the parallel reave systems. Thus only a few cereal pollen grains were found in prehistoric contexts in pollen profiles at the southern end of the Dartmeet parallel system on Holne Moor, though it is intrinsically likely that more cereals were cultivated than show up in the pollen assay. (Maguire *et al* 1983, 78, 92) Similarly only traces of pollen of cereals and arable weeds were found in the Bronze Age levels (WC2) of the peat pollen profile at Wotter Common, in the area of the Shaugh Moor parallel system. (Beckett 1981, 257) Indeed, the absence of cereals in the Bronze Age levels of the soil pollen column on Wotter Common suggests that "the eastern part of Shaugh Moor was not cultivated during this period". (Balaam 1982, 207, 214)

Yet there is almost as much evidence for arable in the moorland zone of the Plym valley. Thus traces of cereals and arable weeds occur in the Bronze Age levels (BB5) at the Blacka Brook pollen site (*op. cit.*,

249) and slightly greater amounts are dated to the later Bronze Age and Early Iron Age at Shell Top. (Jones 1973, 19-21) In addition, some cereal pollen, possibly dating to the Late Bronze Age was found in the pollen profile at Whittenknowles Rocks "in close proximity" to the enclosure, **Mon 747**. (Staines 1979, 35) On the understanding that cereal pollen does not travel far from its source, the implication may be that these crops were grown in the moorland zone. (Edwards 1979 cited in Smith 1982, 249)

Conversely, pollen indicators of arable activity in the parallel systems are far outnumbered (as in the moorland zone) by those of pastoral farming. The high arable:pastoral ratio at the Holne pollen sites suggest that "pastoralism was much more important than cereal cultivation" in the Dartmeet parallel system, though, as Maguire, Fleming and Ralph point out, the proximity of the moorland to the pollen zones may have enhanced the pastoral indicators. (Maguire *et al* 1983, 96) At Wotter Common, the reduction of trees and shrubs and rise in weeds of pasture, notably *Plantago lanceolata*, "indicate a grazing pressure which has only been exceeded in very recent times". (Beckett 1981, 262) Furthermore hoof-marks of domesticated animals, mostly cattle, impressed on the floor of the ditch inside the Phase I (earthen bank/fence) Saddlesborough Reave attest, at least, the traffic of animals through the parallel reave area (Smith *et al* 1981, 214), while phosphate concentrations in the corners of one field at Holne suggest use by sheep. (Fleming 1987, 122).

Thus pastoralism appears to predominate throughout the whole territory from the parallel system to the upper moorland. Therefore any economic contrast between the two areas must be interpreted as a distinction between two aspects of pastoralism. A comparison with the Medieval and Post-Medieval farming practices, identified by H.S.A. Fox, is particularly instructive here. Fox (1971, 110) attributed the contrast between the rough land and small, hedged fields or "closes", documented all over SW England, to a distinction between extensive and intensive pastoralism. Thus Fox points out (1971, 111) that small hedged fields are particularly appropriate for intensive stock-rearing, such as dairying or fattening; they can be "more closely and economically grazed" than larger fields, while the hedge-banks, which would shade, and limit the growth of cereal crops, provide shelter for grass and livestock.

Conditions suitable for intensive stock management could have been achieved in the parallel systems if the long rectangular strips were sub-divided and if the surrounding reaves were topped with fences or hedges, akin to the Medieval hedge-banks. Excavation and survey evidence suggest that this may indeed have been the case. Cross-banks sub-divide the Shaugh Moor field system, while fences such as that discovered on site B at Holne may have been used to enclose smaller units elsewhere. (Collis 1983, 56-7 fig 6; Fleming 1988, 89-90) Furthermore Fleming provided persuasive arguments for the existence of some form of super-structure atop at least some of the reaves. (Fleming 1978, 100)

Continuing the Medieval analogy, the moorland zone, including the Upper Plym valley, may then have been used for extensive pastoralism. Open grazing on less carefully-managed pasture would be perfectly adequate for the production of store cattle or store lambs. It would also be suitable for wether flocks maintained for the production of wool, and some knowledge and use of wool is attested by the spindle-whorls recovered from hut-circles in the moorland zone at Dean Moor (Huts 5B and 6) and, in UPV, at Legis Tor (Mon 2261). (Fox 1957, 65-6 fig 22; Baring-Gould *et al* 1896, 185 Plate VIII)

However of particular significance is the fact that these forms of extensive pastoralism can be pursued on rough land all year round. This then requires at least some of the enclosures and hut-circles in UPV to have been permanently, rather than seasonally, occupied. Wainwright and Smith (1980, 114-5) suggested that the occupation of enclosure 15 on Shaugh Moor was seasonal because of the absence of hearths and because the phosphate levels and number of flint and stone artifacts are insufficient to account for the 1000-year lifespan of the settlement. However, on the basis of the pottery assemblage, Tomalin (1982, 232-3) prefers to restrict the main episode of occupation to a couple of centuries. Furthermore, other features, such as the SE- and SW-facing entrances and, particularly, their remodelling in the later phase are more consistent with permanent occupation.

However even if this was a seasonally-occupied enclosure, it may not, as Wainwright and Smith emphasise (1980, 115), have been typical of all the settlements in the Upper Plym valley. Indeed, the survey of all the settlement remains in the area suggests that the reverse is true. Thus the wide variation in house size below the contour reave,found by O'Neill (1983, 146), and the consistently larger house-size in this area, as shown above(see fig 2:6), may imply permanent occupation of this area. (Houses above the contour reave will be discussed below.)

According to this model of extensive pastoralism, livestock would mostly roam freely and would not necessarily be enclosed for protection. Therefore the absence of a gateway into enclosure 15 on Shaugh Moor and of phosphate concentrations associated with stabling, which indicated that animals were excluded from the enclosure, does not necessarily weaken its link with pastoralism. (Wainwright and Smith 1980, 114) Nevertheless animals may have been brought into enclosures at certain times and the well-defined entrances into some enclosures in UPV (see above p.29), as well as into the excavated enclosure at Dean Moor could have admitted livestock. (Fox 1957, 30, 56)

A limited amount of arable farming, to account for the cereal pollen found in the moorland zone, would also be consistent with the permanent occupation of the area, though there are some ethnographic parallels for cultivation on seasonally-occupied sites. (Miller 1967) The "lynchets" at Trowlesworthy have been a subject of controversy since they were described by Curwen in 1927 (1927, 283-4). A marked accumulation of soil has certainly developed at the lower, western side of the enclosures, **Mons 156a** and **156b**, but it has alternatively been attributed to soil creep and/or animal disturbance. Thus Lady Fox suggests that animal trampling, particularly after heavy rain, can produce a similar effect to ploughing. (1964, 87) The debate is still unresolved though Price and Tinsley (1976, 151-2) demonstrated that the Trowlesworthy soils belonged to the patch of Moretonhampstead soils, which covers Shaugh Moor and Wigford Down, and are sufficiently fertile to support cultivation.

Some of the small rectangular plots or yards (listed above, table 2:2) found in some enclosures in UPV and elsewhere, notably Riders Rings, could also have been "corn-plots" as suggested by Curwen (1927, 283), though they have also been interpreted as stock-pens. (Fox 1964, 86-7; Hamond 1979, 158; Fleming 1979a, 125) In response to their small size for arable purposes, Curwen noted that corn-plots in the Scottish

Highlands in the late 18th century were described as being "no larger than the floor of an ordinary room". (Curwen 1927, 283)

It is further possible that arable activity may explain the distinction noted above between enclosures with centrally-located hut-circles and those in which the hut-circles are arranged around the perimeter, thereby maximising the structure-free area. A contrast may be made in the latter category between enclosures, which simply join up existing structures, such as Mon 452 at Legis Tor, and those, in which subsequent building is also carefully restricted to the edge, such as Mon 12 at Trowlesworthy Tors. At the former the structure-free interior may be a coincidental result of the construction of the enclosure, whereas at the latter sites the interior was deliberately kept clear, possibly for cultivation. In cases, such as Mon 12, the rectangular plots around the perimeter, may indeed have been stock-pens, if the structure-free interior was cultivated.

Such enclosures or plots at Trowlesworthy may account for the cereal pollen in the Blacka Brook pollen profile. As noted above, the plots in the Whittenknowles enclosure, Mon 747a, may be of Medieval origin, but the cereals, which occurred in the Whittenknowles pollen profile, could have been cultivated in cleared areas within the enclosure such as that to the S of hut-circles, Mon 757 and 758. However as always the possibility of timber or turf structures in these areas cannot be discounted.

Finally the use of grain in the moorland zone is attested by the discovery of saddle querns and cereal grains at enclosure 15 on Shaugh Moor and saddle querns at Dean Moor and Scad Brook. (Wainwright and Smith, 1930, 104; Fox 1957, 70; Masson Phillips 1982, 61) Grain could have been imported, though this is perhaps "no more plausible than the idea that the corn was home produced". (Price and Tinsley 1976, 149).

Therefore in the moorland zone of the Plym valley, a permanent population may be envisaged growing some crops but concentrating on some form of extensive pastoralism. It may be suggested that this recognition of permanent occupation in the valley zone clarifies Fleming's interpretation of the Upper Plym valley below the contour reave as "a zone of pasture land allocated to the users of Shaugh Moor (parallel reave) system". (Fleming 1984, 13) Thus while the parallel system and valley zone can still be viewed as complementary aspects of a single "territory", belonging to a single "community", they would be permanently occupied by two separate groups, though these would most probably co-operate closely. For example, the moorland group may have produced store cattle or lambs which were transferred to the parallel system for fattening.

2.3.3 The distinction between the upper and lower moorland zones, ie above and below the contour reave.

The distinction between the settlement remains above and below the Willings Walls/Cholwich Town contour reave is beyond dispute. Thus, as demonstrated above, the hut-circles above the contour reave are consistently smaller (predominantly size-group 2), less substantially-built (mostly structure-group IV) and show greater variety in entrance orientation than the hut-circles below the reave.

The list, compiled by Bradley (1978, 60) from ethnographic parallels, of characteristics which are diagnostic of seasonally-occupied shelters include "limited floor area" and "distinctive building materials" as well as "the provision of storage for dairy produce" and "occasionally the absence of hearths". Fleming (1979a, 125-6) further identified a clustering of doorway orientations in the S and SE, in avoidance of the winter north-westerly winds on Dartmoor, as an indicator of permanent occupation and thus wider variety in door orientations as a corollary of seasonal occupation.

Thus the three distinguishing features of the hut-circles above the contour reave are, as O'Néill has already pointed out (1983, 170-180), consistent with seasonal occupation. Furthermore, the presence of conjoined hut-circles or hut-circles with smaller annexes may correspond to the "provision of storage for dairy produce". Good examples certainly occur above the contour reave. For example in the Cholwich Town Main enclosure, **Mon 490** (**Mons 490d, 490f, g** and **h** and **490i** and **j**) and also at Upper Hentor (**Mons 510c, d** and **e** and **515a** and **b**) and Spanish Lake (**Mons 551** and **562**). The "scalloped edges" of enclosures, **Mons 507c, d** and **e**, **Mons 964b** and **c** and **Mon 1000c, d, e** and **f**, could also correspond to storage space. However these instances are outnumbered by examples in the rest of the valley, such as **Mons** 55, 71c and 15b and e at Trowlesworthy Tors and Trowlesworthy House. T he number of hut-circles, which are conjoined or at least arranged in pairs within the Whittenknowles enclosure, is particularly striking and includes **Mons** 752a and b, 753a and b, 756 and 757, 761 and 762, 764 and 765, 767 and 768 and 773 and 774. (Sheet 24) Furthermore it is suggested below that the Cholwich Town Main enclosure may have been occupied throughout the year. This arrangement may therefore relate to some activity which is not firmly associated with seasonal occupation and, further, concentration on conjoined structures may be misleading as there is no reason why some of the structures above the reave, which occur in closely-spaced clusters, could not have had specialised functions.

This recognition of seasonal occupation above the contour reave is consistent with Fleming's tripartite division of territories, in which the higher part of the South Moor corresponds to grazing land, subject to intercommoning between territories (including Walkham, Meavy, Plym, Erme/Yealm, Avon and Upper Dart) but also possibly to seasonal grazing by transhumant people from more distant areas, such as the South Hams.

The upper moorland may be assumed to be common land because, as Fleming points out (1978, 112), its primary use is as pasture, it is too large to be controlled by a single group occupying its centre and, in any case, permanent occupation of such an area would be unfeasible.

The identification of permanent occupation in the valley zone implies that there are three different categories of upland use. Discussion of the use of the upland commons for summer grazing often concentrates on transhumance from farms in low-lying areas and this may well have formed an important aspect of the Dartmoor economy and society. Rights of common on Dartmoor are documented from 1204, but probably "existed ... long before the Conquest". (Moore and Birkett 1890, xii, xvi) The right to depasture commonable beasts (ie cattle, horses and sheep) *levant* and *couchant* (FN1) on the Forest and commons was granted to the border parishes, known as "Venville", but also to the whole of Devon, excluding Barnstaple and Totnes. (*op. cit.* XXIV-XXV)

(FN1 ie. the number of beasts which can be supported in winter by the produce of the tenement. (Moore and Birkett 1890, xvii))

The layout of the parishes suggests the importance of access to the moorland and, as Fleming points out (1978, 106), is closely paralleled in the layout of the prehistoric territories. (see Fig 2:22)

Excavated artefacts of imported materials, such as the spindle whorls and whetstones from Dean Moor (Fox 1957, 66-72) and pottery from Shaugh Moor enclosure 15 (Tomalin 1982, 235-7) and from Raddick Hill, Smallacombe Rocks and Tunhill Rocks (Baring-Gould et al 1897, 165) demonstrate, as Fleming points out (1979a, 125) external contact, though not necessarily a seasonal population.

A second category of upland use may be associated with the members of the "community" who were practising intensive stock rearing in the parallel systems. If the valley zone was permanently occupied, then the parallel system group may have had to rely on the upper moorland for its summer grazing.

Thirdly, it is likely that the inhabitants of the valley zone had access to the upland all year round. It may be argued that the upland, which today is grazed throughout the year in an environment considerably more hostile than in the Bronze Age, could have supported a certain amount of continuous grazing. Elements of the valley zone population could have inhabited the upland zone on a permanent basis perhaps in the larger houses interpreted by Fleming (1979a, 126) as "caretaker houses". **Mon 490f** in the Cholwich Town Main enclosure with an internal area of 26 m^2 and SW-facing entrance, is an obvious example. Indeed, the whole enclosure with its gateways onto both the upland and the valley zone could be associated with permanent use by the valley zone population. Most of the remaining houses are small but belong to all the structure-groups and the entrances, where distinguishable, face SW or SE. It is also more likely to have been occupied throughout the year if it was the "Major Enclosure" of the Plym territory, as Fleming suggests (1978, 109). **Mons 518b** and d (both 25 m^2 in internal area) and **Mon 913** (30 m^2) all in Upper Hentor may also have been occupied all year round.

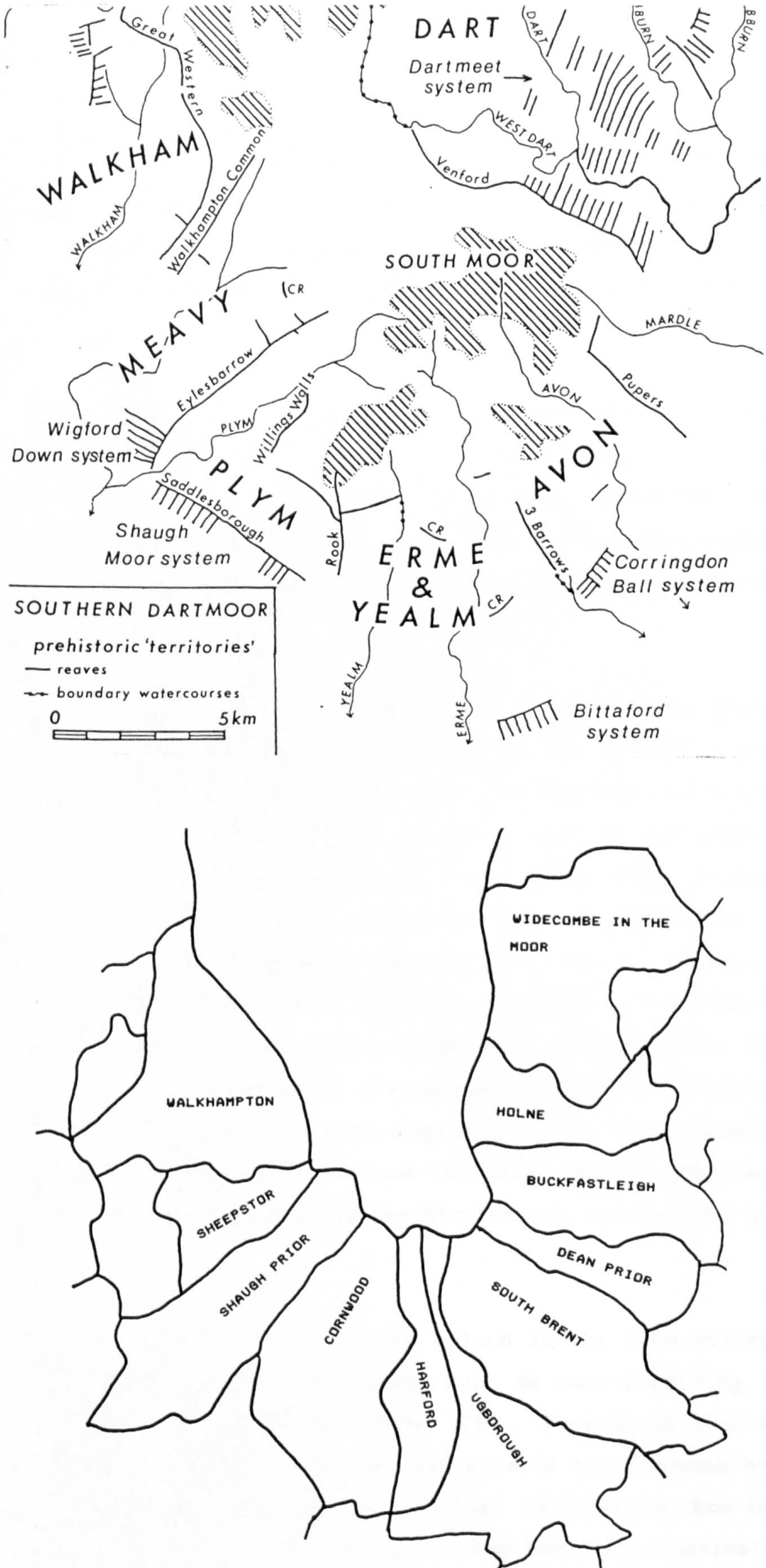


Fig. 2:22 A comparison between Bronze Age territories and Medieval parishes in S. Dartmoor (After Fleming 1988, fig 22 and Somers Cocks 1970, fig 11)

However if the upland could support limited grazing in winter, it would still have been advisable to increase grazing pressure in summer. Fleming (1979a, 120) has already pointed out that heavy grazing can reduce *Calluna* in a pasture to the benefit of grasses. It may be further noted that an increase in grazing pressure in summer is particularly important; if the flush of summer growth is not well-cropped, the dead foggage inhibits growth in the following year. (Angus Robertson pers. comm.)

Thus if the valley zone population, to a certain extent, controlled access to the upland, it would have been in their interests to allow extra livestock in the summer. Furthermore, as Fleming points out (1979a, 122), they would also have benefitted from the external contact in marriage and trade, while it would have been impossible in any case to police the whole upland.

However while transhumant groups were welcome it was presumably desirable to exclude them from the pasture "owned" by the valley zone. The contour reave marks this boundary but, as Fleming points out, the reave built during the "Main Boundary-Making Episode" may simply be the formalisation of a much earlier boundary marked by "territorially-eloquent" cairns or stone rows. (see below) (Fleming 1983, 223; 1978, 109; 1979a, 122) The often unfinished appearance of contour reaves, in contrast to the watershed reaves suggests that the rest of the boundary was well-known and did not need to be marked. (Fleming 1983, 225) Nevertheless the construction of the reaves implies the necesssity of formalisation, possibly, as Fleming suggests (1978, 107), because of increased grazing pressure or because the deteriorating climate and spread of blanket bog emphasised the distinction between the upper and lower moorland.

Livestock could have reached the upland in the Plym valley via droveways through the parallel system, such as that surviving in the Corringdon Ball system (Fleming 1979a, 126). They could then have followed the R Plym to Spanish Lake and entered the Commons by the, possibly original, entrance through Willings Walls Reave, **Mon** 540c with its associated (?contemporary) holloway, **Mon** 568. Alternatively livestock could have taken an eastern route, across Blacka Brook to the entrances through Cholwich Town reave, Mons 480c or 480d.

If this model can be extended to the rest of Dartmoor, then other settlements above the contour reave may also have been seasonally occupied. However the evidence available in a literature search is inconclusive. Among the sites which have been excavated or surveyed, the settlements at Raddick Hill (SX 577 707), Rifle Range, Hart Tor (SX 582 725), Yes Tor Bottom (SX 566 729), Langstone Moor (SX 556 779), Standon Down (SX 549 825), Tavy Cleave (SX 548 835) and Watern Oke (SX 564 835) are all situated above the Great Western/Standon NW and S/Ger Tor contour reave. The position of the contour reave in the Avon valley is unclear, but if it continues, as Fleming suggests (1978, 103), from Stalldown to the Corringdon Ball terminal and Zeal Reave, then the settlements at Riders Rings, Gripper's Hill and Dean Moor are also within the upper moorland zone.

The quality of the information is not consistent; the DEC reports rarely include details of structure. However some criteria of seasonal occupation can be identified and it is clear that few of the sites fulfil all the requirements. At Watern Oke, the hut-circles are certainly small; 74% of the circular structures are under 12 m² in internal area (ie. size-groups 1 and 2) but the entrances consistently face S. (Anderson 1906, 101-113) Only three structures are more closely identified with seasonal occupation, though they could alternatively have been stores; huts 21a, 23 and 33 face N and were described as "an irregular clumsy-looking dwelling", "not well-built - originally of earth and small stones" (ie. structure group IV) and "small and irregular .. constructed of very large stones" (?structure group I). (*ibid.*) Small hut-circles are also recorded at Raddick Hill; five out of seven are under 12 m² but the two recorded door orientations face SE and SSW. (Baring Gould *et al* 1896, 191-2)

The evidence from Dean Moor is also ambiguous. Fleming (1979a, 126) suggests that the wide range in door orientation is indicative of seasonal occupation. This is supported by the type of construction, which seems to correspond to structure group II but was described as unstable and "poor", compared to the double-face construction at Kestor. (Fox 1957, 25) However the hut-circles are all relatively large (all over

20 m^2 ie. size-group 4), while the range of activities indicated in the artifact assemblage might be more consistent with permanent occupation.

At Yes Tor Bottom, the two largest hut-circles (25.4 m^2 and 19.8 m^2), are particularly well-built, one with a clear double face and the other with a protecting wall around the northern half, and were surely designed for year-round occupation. (Baring-Gould *et al*, 1898, 99-104) At Standon, details are not recorded in the excavation report but the survey plan shows that the hut-circles vary in size and, with two exceptions, face SW-SE. (Baring-Gould ed. 1902, Plan) Hut-circles on the remaining sites, Tavy Cleave, Rifle Range, Riders Rings and Gripper's Hill, mostly belong to size-group 3 (12 ^{2}m-19 m^2) and consistently face in southerly directions. (Baring-Gould 1894, 198; Baring-Gould *et al* 1896, 189-191; Worth 1935, 118; Fox 1955, 57-60)

Therefore there is no unequivocal evidence for seasonal occupation above the contour-reave outside the Plym Valley. However if O'Neill's suggestion (1983, 144) that size is the most important criterion and that 20 m^2 is the minimum area for a nuclear family, is followed, then the settlements at Watern Oke, Rifle Range, Raddick Hill, Grippers Hill and most of Yes Tor Bottom are all seasonally-occupied. It should be emphasised that these examples are only the sites which have been investigated and are probably not representative of the settlement pattern as a whole. Further there is little published information on any valley-zone sites in these areas for comparison. However, Shaugh Moor enclosure 15 clearly contrasts with the upper moorland sites in the Plym valley and the Scad Brook hut-circle, below the contour reave in the Avon valley, is more strongly-built than those at Dean Moor. (Wainwright and Smith, 1981; Masson Phillips 1982) Detailed survey is required to further reveal this distinction between the upper and lower moor.

2.3.4. The relationship between ceremonial and burial remains and settlement evidence

a) Stone Rows

The high concentration of stone rows on Dartmoor compared to the rest of the British Isles "argues for the adaption of a ritual tradition which became very strongly rooted". (Quinnell 1988, 3; see Emmett 1979, Fig. 8) Six out of the 70 or so recorded on Dartmoor, occur in UPV. (described in detail in App.F) **Mon 274b** on Ringmoor Down, measuring 337m is the longest. It appears to be a double row though it has been heavily robbed, particularly within one Medieval field. Another double row, **Mon 48a**, though better preserved, occurs at Trowlesworthy, adjacent to a single row, **Mon 42a**. The three stone rows at Drizzlecombe, **Mons 1011a, 1025a** and **1026a**, with their tall terminal stones, are particularly impressive and form the focal point of a collection of monuments including cists, cairns and cairn-circles which indicate the importance of this area as a ceremonial centre. Worth (1946, 293) suggests that there may have been an intention to construct a fourth stone row between the standing stone, **Mon 1012** and cairn-circle, **Mon 1027**, to form a symmetrical pattern. **Mons 1025a** and **1026a** are single rows but **Mon 1011a** seems to be double for about 50m of its total length of 144m. The UPV rows conform to Emmett's observation (1979, 98) that few Dartmoor stone rows are straight. The two Trowlesworthy rows change alignment at their approximate mid-point and **Mon 1026a** curves gradually southwards from a point 39m from the top.

All six rows terminate in cairn-circles, though are not necessarily contemporary with them. Examination by Quinnell (1988, 7) confirms the possibility raised by Burl (1976, 111) that cairn-circles are not necessarily integral parts of the stone rows. This is supported by at least one example from UPV; the stone row **Mon 1025a**, is clearly not aligned on the centre of its cairn-circle, **Mon 1025b**.

b) Stone Circles

Apart from these cairn-circles, there are a few larger stone circles in the valley, of which **Mon 366** at Brisworthy (25.50m in diameter) is the best-known. Burl (1976, 109) noted that this circle was the sole exception to his observation that Dartmoor stone circles are consistently composed of between 30 and 36 stones regardless of size. This circle after restoration in 1909 consisted of 22 stones, but Worth (1916, 99) suggests that it originally contained 42. However extrapolation from the best-preserved sector in the NW, where stones are set at an average of 2.30m apart, would result in a full circle of 35 stones, thereby conforming to Burl's rule.

A stone circle **Mon 549** in Willings Walls Warren may be another example of this pattern. Here some effort must have been made to include the full quota of 36 stones into a relatively small space, resulting in an irregularly-shaped "circle" of stones, sometimes two abreast. A further three monuments are tentatively included as stone circles. The group of four, possibly five, clusters of stones, **Mon 572** also at Willings Walls have been discussed by Worth (1942, 207) and regarded by Burl (1976, 107) as "dubious". Two adjacent roughly circular settings of stones, **Mons 569 and 570**, were discovered in the present survey and consist mostly of irregular boulders. Finally, the stone setting, **Mon 491** may be included in this category, to add to the collection of monuments around Shell Top, recorded by Fleming and Collis (1973 fig 15).

c) <u>Cairns</u>

A total of 68 cairns were recorded in UPV, including 24 containing cists. A further four cists were recorded, which have no surviving trace of a cairn (see Table 2:6). An additional 17 cairns, **Mons 85a-e, 90a and b, 110a-g, 167, 589g and 620b**, may be associated with later field clearance.

The cairns on Dartmoor have already been fully described and analysed by L. V. Grinsell (1978). However, eight new cairns, **Mons 411, 476, 477, 505, 947, 1025c, 1057 and 1072**, and two cists, **Mons 556 and possibly 1049**, (see Fig 5:23) may be added to his list, though **Mon 411** at Trowlesworthy could be alternatively associated with rabbit warrening and **Mon 1025c** may be a result of the re-erection of the menhir, terminating the stone row, **Mon 1025a**, at Drizzlecombe. Furthermore, **Mons 476 and 477** could correspond, with different grid references, to two of three Grinsell cairns (Shaugh Prior 33, 34 and 35) which were not located in the present survey. (Grinsell 1978, 164) Some cairns recorded by Grinsell have been reinterpreted; his "Sheepstor 16a-i", (1978, 166) formerly marked as

Table 2:6 Table of Cists in the Upper Plym Valley.

Mon No	Orientation of Cist	Cairn Size (m)	Retaining Circle	Grinsell*
100	NE-SW	5.20 diameter	in W Sector	SP 30a
312	NW-SE	8.00 x 6.90	5.20 x 5.10	S 20
544	WNW-ESE	6.00 x 5.50	-	SP 31
556	NW-SE	8.40 x 7.00 pear-shaped	-	-
571	NW-SE	4.60 x 4.00	large stones	SP 25
573	NW-SE	8.50	2 stones in W sector	SP 24
598	NW-SE	4.00 diameter	3 large stones in SE sector	S 23
599	E-W	5.00 diameter	Closely-set orthostat	S 22
668	N-S	-	-	S 15
708	NE-SW	4.80 x 4.50 Oval	?2 concentric circles	S 9
721	WNW-ESE	5.50 diameter	Arc in NW sector	S 7
1009	NW-SE	6.40 x 4.90	-	S 34
1024	?	-	-	S 33d
1030	NW-SE	12.50 x 11.50	-	S 25
1049	?	-	-	-
1054	? W-E	9.50 diameter	-	S 31
1067	NW-SE	-	-	S 24
1073	NW-SE	5.00 diameter	Stones in N, SW + E Sectors	SP 19
1074	NW-SE	9.00 diameter	Stones around perimeter; 5m	SP 18
1076	NW-SE	4.00 diameter	10 orthostats; 4m diameter	SP 13
1077	NW-SE	6.00 x 5.50	-	SP 16
1083	NW-SE	7.30 x 6.10	6 orthostats in W, N + E sectors; 5.50 x4.00	SP 4
1168	NW-SE	6.00 x 4.50	-	SP 11
1169	NW-SE	c. 4.00 diam	-	SP 10
1170	WNW-ESE	5.00 x 5.20	in S sector; 3.50m diameter	SP 12
1172	WNW-ESE	hummocks	? in NW sector	SP 7
1172	NW-SE	low cairn	6.00 x 7.00	SP 8
1176	NW-SE	11.5 x 11.0	-	SP 3

* S = Sheepstor.
SP = Shaugh Prior.

tumuli on OS Maps, and "Shaugh Prior 9, 9a and 9b" (1978, 162) are now interpreted as hut-circles, **Mons 662, 663, 664, 665b** and **c, 618b, 621, 622** and **623** on Ringmoor Down, and **Mons 1173e, 1173c** and **1173f** at Langcombe Brook respectively. Further, Grinsell's Shaugh Prior 14 (1978, 163) may be a mine shaft, **Mon 1003**, similar to others in the vicinity at Shavercombe Brook. Other cairns, recorded by Grinsell, but not located in the present survey are noted in Appendix G.

Cairns are distributed predominantly on the upper slopes of the valley, with concentrations at Drizzlecombe and around Langcombe Brook. Only a few, such as **Mon 100** at Trowlesworthy and **Mons 311** and **312** at Legis Lake occur in the lower valley. Seven fall into the category of "prestige cairns", classified by Grinsell (1978, 110) as those over 20m in diameter, situated mostly on summits or ridges. A further three or four may be included if the diameter is reduced, as Grinsell proposed (*ibid.*), to 15m. Most of these indeed occur on ridges or summits, though **Mons 472** and **704** are well below the summits of Shell Top and Ringmoor Down respectively. Giant's Basin, **Mon 1023**, is also situated at a lower level but was presumably associated with the Drizzlecombe "sanctuary".

Thirty cairns, half of which are associated with cists, have traces of a retaining circle. In four cases, principally the cairns at the top of the stone rows, **Mons 42b, 48b** and **274a**, but also **Mon 272**, the retaining circle is the dominant feature and resembles a stone circle. Other retaining circles are particularly well-preserved, notably the circle, 4m in diameter, of ten orthostats, surrounding Grims Grave, **Mon 1076**. (See Fig. 2:23) The contrasting positions of the stones at the top of the cairn **Mon 708** and two around the lower edge suggests that these are the remains of two concentric circles. (See Fig. 2:23) Further, Robinson and Cosford (1986, 169 fig 3) have recently suggested that three or four circles surround the cairn, **Mon 1027**, at Drizzlecombe. (See Fig. 2:23)

Most of the cairns are round and any irregular shapes may be a result of weathering. However, the oval-shaped retaining "circle" at **Mon 1083** suggests that the oval shape of the cairn was originally intended. Grinsell suggests (1978, 100) that the cairns were probably originally defined by the retaining circles but that some, such as **Mons 312, 1074,**

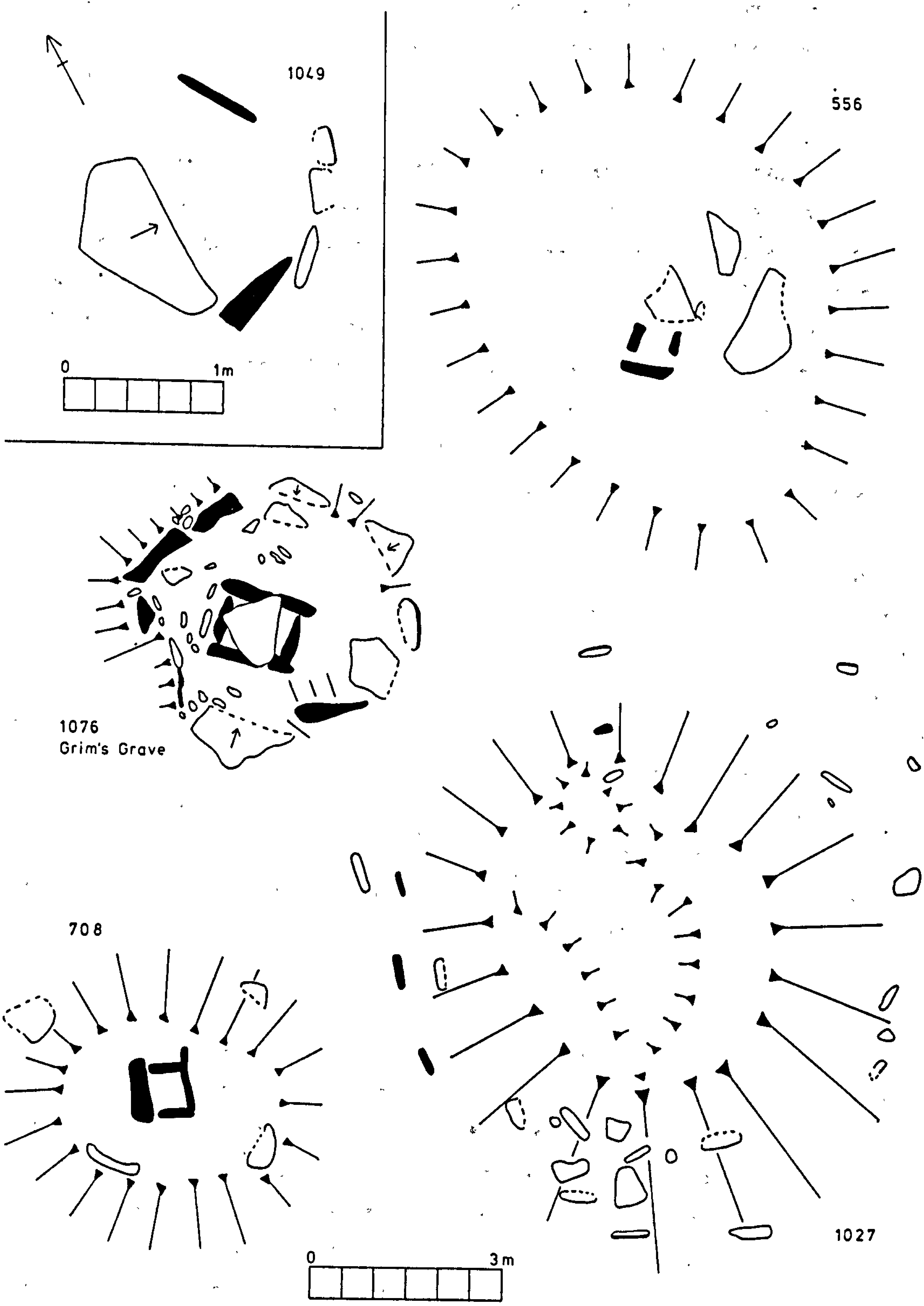


Fig. 2:23 Cists in the Upper Plym Valley

1083 and 1170, have now spread over the kerb. Worth (1957, 178) and Grinsell (1978, 99) observed that the orientation of the vast majority of cists lay in the NW (or SE) quadrant, and the UPV examples are no exception. (See Table 2:6)

d) <u>The relationship between burial, ceremonial and settlement evidence</u>

The relationship between the burial and ceremonial remains on the one hand and the settlement evidence and sequence of occupation in the Upper Plym Valley on the other may now be considered. The stone rows and stone circles are undated, but evidence from other parts of Britain (Burl, 1976) suggests that some of these were constructed in the later 3rd millennium BC. (Quinnell 1988, 3) Round cairns date mostly to the first half of the 2nd millennium BC with a peak at *c.* 1800 BC, though, as Quinnell suggests, the cist and cairn, Mon 1172c at Deadman's Bottom in UPV, which contained a European bell-beaker, may date to the later 3rd millennium BC. (Quinnell 1988, 3-4; Clarke 1970, 479 Fig 91) These, therefore, predate the "main boundary-making episode" and the bulk of the settlement evidence but a distinction between "earlier" ritual monuments and "later" settlements and boundaries is too simplistic and considerable overlap is now acknowledged. Thus Quinnell demonstrates that calibrated C^{14} dates for Shaugh Moor 15 and Phase I reaves begin before 1500 BC and overlap with barrows, associated with Plymstock/Wessex II metalwork (1650-1450/1400 BC), and she suggests that "considerable evidence may be expected to accumulate for many [hut circles and enclosures] to be within the first half of [the second] millennium". (Quinnell 1988, 8 and Fig 1)

Environmental investigations suggest that for the whole postglacial period "there is no convincing evidence for the existence of woodland on Dartmoor above 415m".(Caseldine and Maguire 1981, 6) At the pollen site of Black Lane Brook, *c.* 750m E of Plym Head, presence of non-arboreal pollen in Mesolithic levels, mostly *Calluna* and Gramineae, "might suggest the presence of open land". (Simmons 1964b, 169; 1969, 206) Thus Fleming suggests that the uppermost crown of the moor would have been valuable open land in the Mesolithic and that gradually clearance of the moorland fringes extended the open pasture "outwards and downhill". (Fleming 1983, 200) The location of chamber tombs and long cairns between 300m and 400m O.D. suggest use of the upland in the Neolithic. (Fleming 1987, 112)

The construction of stone rows from the later 3rd millennium BC, within this upland pasture may then be interpreted as the action of individual groups staking a claim to particular areas of grazing. (Fleming 1987, 97)

Analysis of soil pollen from a site adjacent to a stone socket in the Cholwich Town stone row, SE of UPV indicated that the row had been constructed in a clearing, which had regenerated with heather and grass after an episode of cereal cultivation and was then surrounded by alder, hazel and oak. (Simmons 1964c 37) If the stone rows were built, as Simmons concluded, "in open land ... at the forest margins" they could indeed mark the lower edge of a tract of pasture. They were possibly restricted, as he further suggests to "worked-out land" by people with an "eye for land value". (*op cit.* 38) Location in abandoned clearings might then explain the frequent orientation of stone rows downslope; as Emmett points out (1979, 107), "window-felling could have resulted in cleared swathes running roughly downhill".

The Trowlesworthy stone rows are almost at right angles to each other, but these and the other UPV rows could still be described as being orientated roughly downslope and could therefore be interpreted according to this model. The stone rows would then mark the approximate edge of the contemporary forest, occupying the valley floor.

No obvious pattern emerges of a relationship between stone rows and particular territories across Dartmoor as a whole, though the presence of timber rows, suggested by Quinnell, could significantly alter the distribution. (Quinnell 1988, 3) However O'Neill has identified possible "sub-territories", defined by prehistoric boundaries and streams, associated with the UPV rows. (O'Neill 1983, fig 8.21) Thus on the N bank, sub-territories associated with the Ringmoor Down stone row, **Mon 274b** and the three Drizzlecombe stone rows, **Mons 1011a, 1025a** and **1026a**, are bounded by the Eylesbarrow Reave, **Mon 271**, and the R. Plym and separated by Gutter Mire. The Trowlesworthy stone rows, **Mons 42a** and **47a**, are related to a sub-territory bounded by the R. Plym, Blacka Brook and possibly the Trowlesworthy reave, **Mon 379**. O'Neill further suggests that the Cholwich Town row is associated with the area between the Cross-Dyke, **Mon 474** and the Cholwich Town reave, **Mon 480** and eastwards to possibly two separate areas related to the two Penn Beacon stone rows.

(O'Neill 1983, 206) Finally, the Shaugh Moor row is identified with the area between the R. Plym, Blacka Brook and Saddlesborough terminal reave.

It may be further suggested that the conjunction of stone rows, menhirs, cairns and retaining circles in the Drizzlecombe "sanctuary" has a wider significance than simply defining the pasture of one group. Only two comparable sites are found on Dartmoor: Merrivale in the Walkham valley and Shovel Down, near Kestor, and it is possible that these sites formed the focus of some regional ceremonial activity for S, W and NE Dartmoor.

Some cists and cairns, including **Mon 1172c** at Deadman's Bottom, may be contemporary with the late 3rd millennium construction of stone rows. At an altitude of about 390m O.D., the latter cairn is not far below the maximum tree line (415m O.D.) and, within the "tonsure" model of forest clearance, an early date is plausible. Other cists and cairns at this altitude, particularly the immediately adjacent cist, **Mon 1172b** and ring cairns, **Mons 1172a** and **d**, could be equally early, though there is no corroborative evidence. Only **Mon 1176** at Calveslake Tor with a Beaker-associated tanged arrowhead can confidently be assigned to a relatively early date. (Grinsell 1978, 90)

As noted above most of the cairns on Dartmoor are dated to the first half of the 2nd millennium BC. Fleming (1983, 200) suggests that further identification of individual groups with particular grazing areas eventually led to the demarcation of these areas by large prominently-positioned cairns. UPV is particularly well-defined by skyline cairns on both sides of the valley. On the N bank, the two Eylesbarrow cairns, **Mons 1102** and **1163**, both 25m in diameter, and two adjacent cairns on Ringmoor Down, **Mons 280** and **281**, measuring 22.50m and 21m respectively, are impressive examples of Grinsell's "prestige cairns". (Grinsell 1978, 110) The N watershed is further marked by two smaller cairns, **Mons 297** and **299**, though the latter (at 16m) may still be included as a prestige cairn. The S watershed is marked by two examples of the smaller prestige cairns, **Mons 1071** and **1072** (15.50m and 14.50m in diameter respectively) and the cairn added to Shell Top, recorded by Fleming and Collis (1973, 20).

The presence of these prestige cairns, marking territories and of smaller cairns and cists, dotted around the valley must correspond to greater use of the upland in this period. Indeed the construction of stone rows and cairns coincides with the evidence, found by Simmons, for woodland clearance on Dartmoor between 2400 and 1400 BC. (Simmons 1969, 208) Some of the settlement remains may therefore be expected to relate to this period of upland use, possibly associated with seasonal occupation by a transhumant population, as suggested by Fleming (1984, 16). Some cultivation must have accompanied such summer occupation in this early period, to account for the cereal pollen which pre-dated the Cholwich Town stone-row, though its presence in a clearing may alternatively indicate the association of settlements with a nomadic population, practising slash and burn cultivation, as suggested by Simmons (1969, 208). The distinction between transhumant and nomadic occupation is unlikely to be identified from surface indications; settlements of both are probably small and less substantially-built than those associated with permanent occupation. Certainly a peripatetic population of some sort might account, as Quinnell suggests, for the relative dearth of pottery in Dartmoor barrows. (Quinnell 1988, 7 Fig 2)

On present evidence none of the structures in UPV can be assigned with any certainty to this early period. In accordance with Fleming's model of early transhumant occupation, some of the hut-circles which display characteristics of seasonal-occupation, could belong to an early phase, though in the absence of firm dating evidence, it would be difficult to isolate these from the seasonally-occupied structures, which were suggested above to be contemporary with some permanent occupation in the later second millennium BC. The limited relative chronology within the settlement corpus is no help; as shown above, the hut-circles, which clearly pre-date their enclosures and may therefore be considered to be relatively early, are larger than average. (See Fig 2:7) In only one case is there any relationship between settlement and burial or ceremonial remains; the N wall of the enclosure, **Mon 1042a**, at Drizzlecombe flattens as if in an inwards kink to avoid the cairn, **Mon 1043**. (Sheet 25) This may suggest that the enclosure is of sufficiently early date to respect the cairn, in contrast to, for example the Cholwich Town / Willings Walls reave, which simply runs over or incorporates cairns. However it is also possible that the Drizzlecombe sanctuary had a longer-lasting significance than isolated barrows and still operated as a ceremonial centre during the enclosure phase.

When the pattern of reaves (or more correctly, their earthen or timber predecesssors) was laid out, accompanied by permanent settlement, after *c.* 1700 BC (Quinnell 1987 Fig 1) the landscape was thus already occupied and, to some extent, sub-divided. The Plym territory, defined by the Eylesbarrow and Rook reaves, was already marked by a series of "prestige cairns". The reaves incorporate some of the cairns but ignore others; thus the Eylesbarrow reave, **Mon 271** laps over the edge of the northern cairn, **Mon 1163**, on Eylesbarrow hill and seems to kink southwards in order to pass close beside the cairn, **Mon 299** on Ringmoor Down (Sheet 22) but by-passes at a distance of 80-125m the two large cairns at the western end of the ridge, **Mons 280** and **281**. Rook reave incorporates Penn Beacon cairn and passes close by the "embellished tor" on Shell Top before becoming engulfed in blanket bog. (Fleming and Collis 1973, 9-10)

The number of cairns and stone circles along the route of the Cholwich Town/Willings Walls contour reave suggest that this boundary was also defined in the earlier part of the second millennium BC. Thus the Cholwich Town reave, **Mon 480**, abuts or possibly runs over the cairn, **Mon 481**, and the Willings Walls reave, **Mon 540**, incorporates two small barrows, cuts through a group of cists and appears to kink slightly around a possible ring-cairn, **Mon 567**. (Fleming and Collis 1973, 4) In addition, three stone-circles, (including two newly-discovered in the course of the present survey) **Mons 549, 569** and **570** are situated above the Willings Walls reave and a possible fourth, **Mon 572**, is bisected by it. (Sheet 9)

This implies that the distinction between upper common land and lower "owned" land already existed in the earlier part of the second millennium at a time when only a seasonal population is postulated. This may then suggest that permanent occupation can be pushed back further to be contemporary with cairns. There is already an overlap in the Plym Valley between the cairns and some houses (though not indisputably permanently-occupied) on Shaugh Moor. (Balaam *et al* 1982, Fig. 25)

2.3.5 The pre-eminence of the Upper Plym Valley

A study of the prehistoric monuments in the Upper Plym Valley reveals that this "territory" contains, firstly, a greater density of settlement remains than most comparable areas elsewhere in Dartmoor, secondly, the most complex pattern of land division including the full suite of types of reave and, thirdly, one of the few "ceremonial centres" on the moor. An explanation for the coincidence of these three distinguishing features must be sought.

The greater number of settlements, reaves as well as prestige cairns and stone rows in southern Dartmoor compared to the dearth of such monuments in the North, may be explained, as Fleming suggests (1983, 216-7), by the earlier spread of blanket bog on the higher northern moor, which would have curtailed prolonged occupation. However, this does not explain the prominence of the SW in general, and the Plym valley in particular, above the rest of southern Dartmoor.

There can be little doubt that "the value of land in agrarian terms was the main consideration for those who were so assiduously subdividing at this time". (Fleming 1987a, 124-5) However it is hard to avoid the conclusion that a larger than usual population was attracted to the Plym by its mineral resources. The evidence for prehistoric tin-working on Dartmoor has already been considered in detail by Penhallurick (1986, 115-8) and Greeves (1983, 23-5) and will not be repeated here. However, it may be noted that the exploitation of local china clay, evident at Shaugh Moor (Peek and Warren 1979, 27), and suggested by Penhallurick (1986, 118) as a corollary of tin-working, may also be evident in Bronze Age UPV. Thus a cracked pot in a hut-circle at Legis Tor, **Mon 227d**, had been mended *in situ* with china clay. (Baring Gould *et al* 1896, 187, Plate VIII)

The value of settlement evidence in the discussion of prehistoric tin-working is a matter of debate. A connection was proposed by Crossing (1890-91, 178) and Burnard (1891a, 91, 93) and, more recently, by Price (1979, 1985, 1988) and Smith (1982). Fleming prefers the discussion to concentrate on metal analyses and evidence of local metal-working industries, suggesting that the density of settlement could be attributed to episodic or seasonal occupation, while there is no comparable density of settlement associated with Medieval tin-working. (Fleming 1987b, 118-121) However, as Price points out (1988, 93), early Medieval tinners were discouraged from living within the Forest boundary and, as Crossing notes (1888-9, 136), "there was indeed no absolute need for them to do so, for they had towns and villages all around the confines of the moor", circumstances absent in the Bronze Age. Furthermore, as suggested above, at least some of the settlements may have been occupied all year round, and it is notable that so many enclosures are arranged carefully on the edge of the alluvium as if poised to exploit the resources below. It may be significant that the division of land and increased occupation of the moorland, beginning *c.* 1700 BC, coincides with the Plymstock/Wessex II metalwork phase (1650-1450 BC), which is exactly when Pearce suggests that local ores were first exploited. (Pearce 1983, 116; Quinnell 1988 fig 2)

3.1 INTRODUCTION.

Remains of twelve Medieval farms are identified in UPV. (Fig. 3:1) Five (Spanish Lake, Willings Walls, Shavercombe, Shavercombe Foot and Whittenknowles) consist simply of a longhouse and a few enclosures but seven are associated with extensive field systems (Trowlesworthy, Hentor, Ringmoor Down, Legis Lake, Legis Tor, Gutter Tor and Ditsworthy). The value of detailed examination and analysis of field evidence in a study of Medieval farming on Dartmoor is well-demonstrated by Fleming and Ralph's work on Holne Moor. (1982) They rightly point out that much information can be detected in the morphology of field boundaries and horizontal stratigraphy and it may be true to say that field evidence of Medieval farming is "too often ... used simply to illustrate or accompany the evidence provided by contemporary documents, or as impressive visual evidence of general historical trends." (Fleming and Ralph 1982, 101)

However, the contribution of contemporary documents or the historical background can be significant. A considerable body of contemporary documents survives for UPV, which provides a chronological and economic framework for the archaeological evidence. Furthermore, as will be seen, local events and national trends influenced the development of settlement in UPV. Thus a detailed analysis of archaeological evidence for Medieval and Post-Medieval farming provides much information on the development of settlements and type of land use in UPV, but when it is viewed in conjunction with documentary evidence against the historical background, the landscape can even more fully come to life.

3.2 ARCHAEOLOGICAL EVIDENCE

3.2.1 Introduction

The archaeological evidence for Medieval and Post-Medieval farming in UPV has been studied to some extent already. Linehan's papers on deserted sites on Dartmoor (1965; 1966) include remains in UPV, though they concentrate on buildings. Price's work (1977; 1980) in the Plym Valley includes a discussion of post-prehistoric structures (1980) and an account of the development of settlement at Trowlesworthy. (1977) More detail is supplied in Haynes' Maps; although chiefly on the rabbit

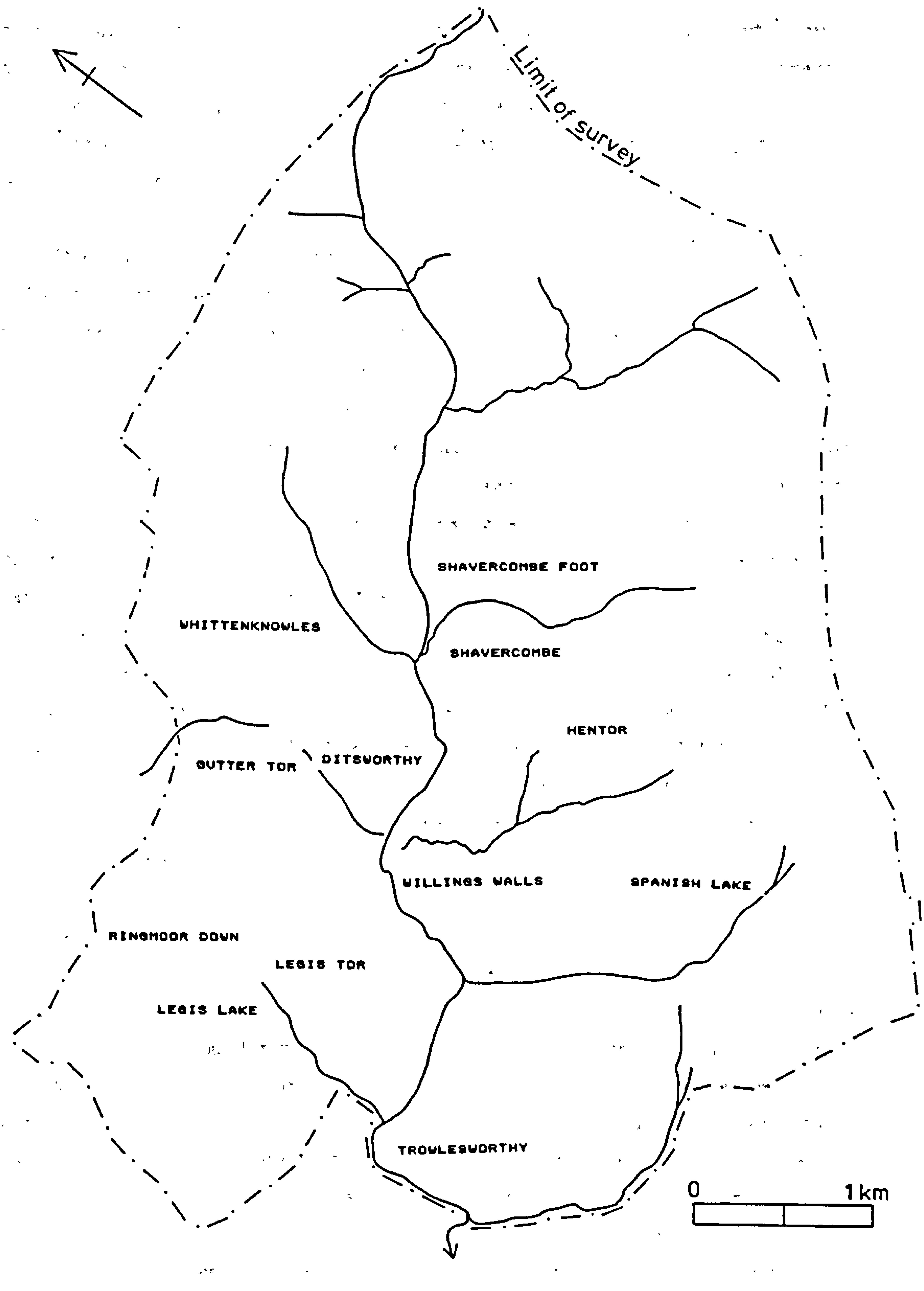


Fig. 3:1 The location of farmsteads in UPV

warrens of the Plym Valley, these include details of the Medieval occupation. (Haynes' Maps TRO, VIL, HEN, LEG, DIT) However, apart from the 19th century changes in field patterns at Trowlesworthy, illustrated by Price (1977, 43), there has been little attempt to trace the sequence of construction of fields and boundaries in the Medieval and Post-Medieval periods.

The considerable prehistoric presence in UPV, followed by a long period of post-prehistoric occupation, from probably the 13th century to the present day, has produced a network of interconnecting and overlapping boundaries and structures. The field evidence relating to Medieval settlement is therefore sandwiched between prehistoric remains and Post-Medieval farming and warrening activities, but can be extracted by a study of the overall plan, and by examination of the morphology of individual elements, and horizontal stratigraphy. Prehistoric construction is morphologically distinct from Medieval, while vermin traps and pillow mounds of Post-Medieval warrening are easily identifiable in the field. Remains of Post-Medieval farming can be distinguished from those of the Medieval period, with reference to contemporary maps, including a "Rough Plan of Trolsworthy" of 1842 (WDRO 710/203), the 1840-43 Tithe Maps and Apportionments (WDRO MFC 710-713, 717-718; 144/2/8; DSMR Sheepstor Tithe App.) and early editions of OS 6 inch maps: the 1st Edition surveyed in 1886, published in 1887 and the 2nd Edition revised in 1904 and published in 1906.

Terminology should first be clarified. Thus "farmstead" refers to the dwelling with its associated outbuildings and yards, while "farm" is applied to the farmstead and its field system. "Wall" is restricted to a stone wall, and "boundary" is used as the general term for walls, banks and corn-ditches. Boundaries are defined according to Fleming and Ralph's classification. (1982, 194-7) (See Fig. 3:2) Thus, a "reave" is a low stone wall, with a symmetric profile, usually vegetation or turf-covered. (*op. cit.*, 107) A "clearance-wall" consists of a linear arrangement of piled-up stones, resulting from field clearance. (*op. cit.*, 106-7) A "block-wall" is a line of large single boulders. (*op. cit.*, 106) A "corn-ditch" consists of a broad earthen bank with a vertical stone face dropping into a ditch on the outer side. (*op. cit.*, 105-6) A "hedge-bank" is an earthen bank with a ditch on one or both sides and was originally topped with a hedge or fence. (*op. cit.*, 105) A "wall-bank" consists of a massive bank, faced on both sides with stone. (*op. cit.*, 104-5) Finally, Fleming and Ralph's term, "wall", for a dry-stone wall of coursed masonry, usually of 18th - 19th century date, is amended here to "coursed wall", to distinguish it from other boundaries of quite different character and date, which also consist predominantly of stone, such as prehistoric enclosure walls. (*op. cit.*. 104)

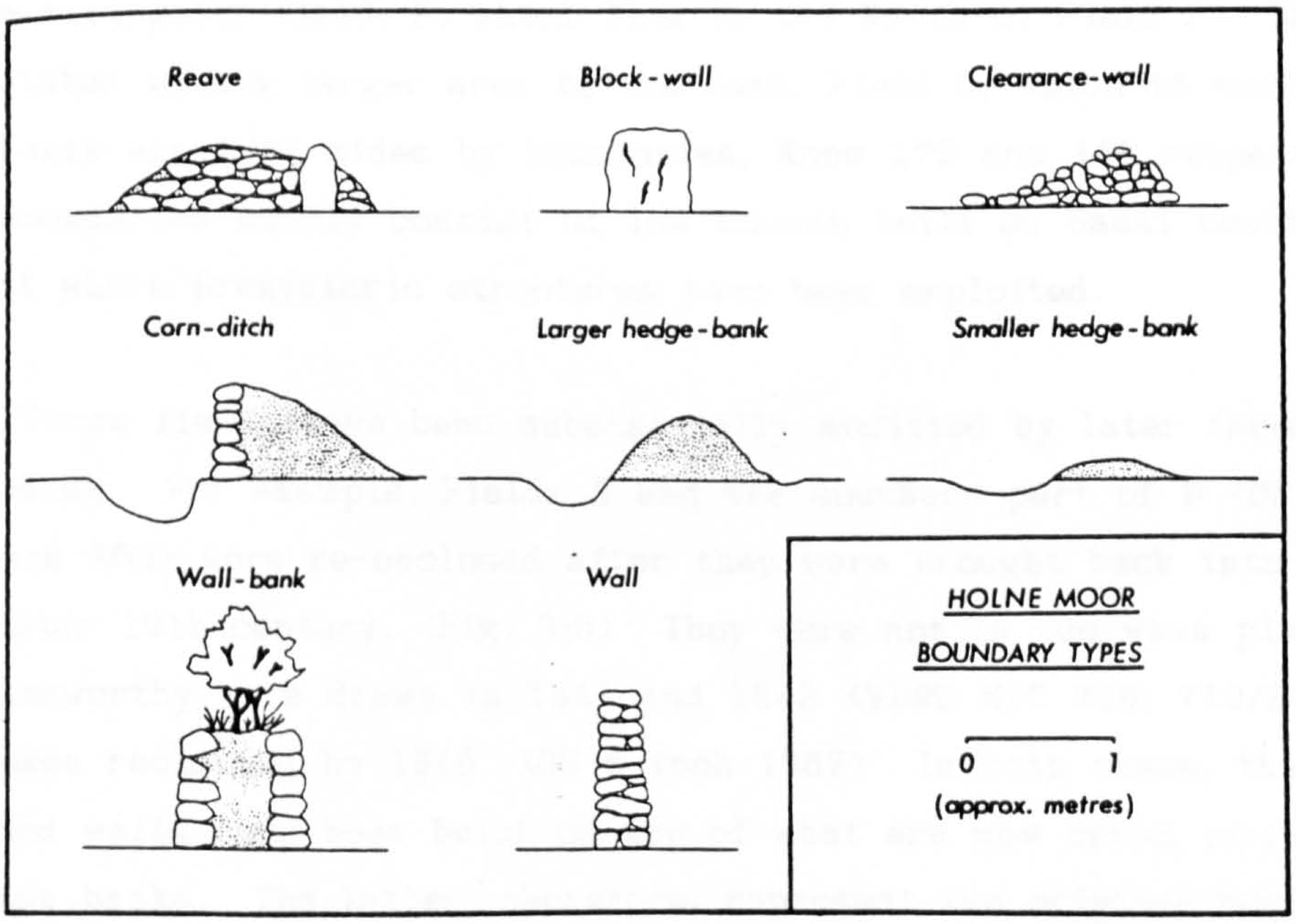


Fig. 3:2 Classification of Medieval boundaries(from Fleming and Ralph 1982,fig 2)

3.2.2 <u>The settlements in the Upper Plym Valley.</u>

a)<u>Trowlesworthy</u>

The boundary of Trowlesworthy is outlined in an early 13th century deed, discussed in detail below (see p.182), and defines an area of 483.39 acres (195.63ha), which corresponds well to the 489 acres recorded on the 1842 "Rough Plan of Trolsworthy". (WDRO 710/203) However, the fields and structures relating to the Medieval and Post-Medieval farming are confined to the lowest part of the area, on a gently-sloping spur, bounded by a right-angled bend in the R. Plym. (See Sheets 6 and 7)

The earliest post-prehistoric settlers seem to have selected the area to the North of the presently-occupied house and fields. (Fig. 3:3) The presence of three prehistoric enclosures as well as several unenclosed hut-circles probably contributed to this choice. The enclosures consist of three small sub-rectangular fields, A, B and C, running across the slope, joined on the South side by a long, sub-rectangular field, D, which is aligned along the contour. To the West, almost reaching the R. Plym, is one long field, F, aligned on the contour, and a triangular field, E, which lies to the North of Field F. These are associated with a larger area to the East, Field G, which is enclosed on the North and East sides by boundaries, **Mons 172** and **146** respectively. The boundaries mostly consist of low mounds built on basal boulders, except where prehistoric structures have been exploited.

These fields have been substantially modified by later farming and warrening. For example, Fields E and the southern part of D (D2) (**Mons 183** and **163**) were re-enclosed after they were brought back into use in the later 19th century. (Fig. 3:6) They were not in use when plans of Trowlesworthy were drawn in 1841 and 1842 (WDRO MFC 710; 710/203), but had been reclaimed by 1886. (OS 6 inch 1887) In both cases, the later coursed walls have been built on top of what are now broad turf-covered earthen banks. The latter, therefore, represent the original boundaries.

The construction of the walls in both cases severed the original relationship with connecting boundaries and altered the original plan. Thus, the present North and South sides of the field, **Mon 163**, relate to the later re-use only. The earthen bank is visible only on the West and East sides and, although the boundaries are damaged by the construction of the later wall of the enclosure **Mon 163**, the basal stone layer of the bank on the East side can be clearly seen to continue uninterrupted into the bank, **Mon 168**. Therefore the original Field D must have included the area to the North of the present field, **Mon 163**, up to the boundary, **Mon 172**.

The original southern boundary has also been altered; the turf banks on the West and East sides stop at the intersection with the prehistoric enclosure, **Mon 156a**. Although all trace of this enclosure is now removed from within the field, **Mon 163**, 19th and 20th century maps indicate that

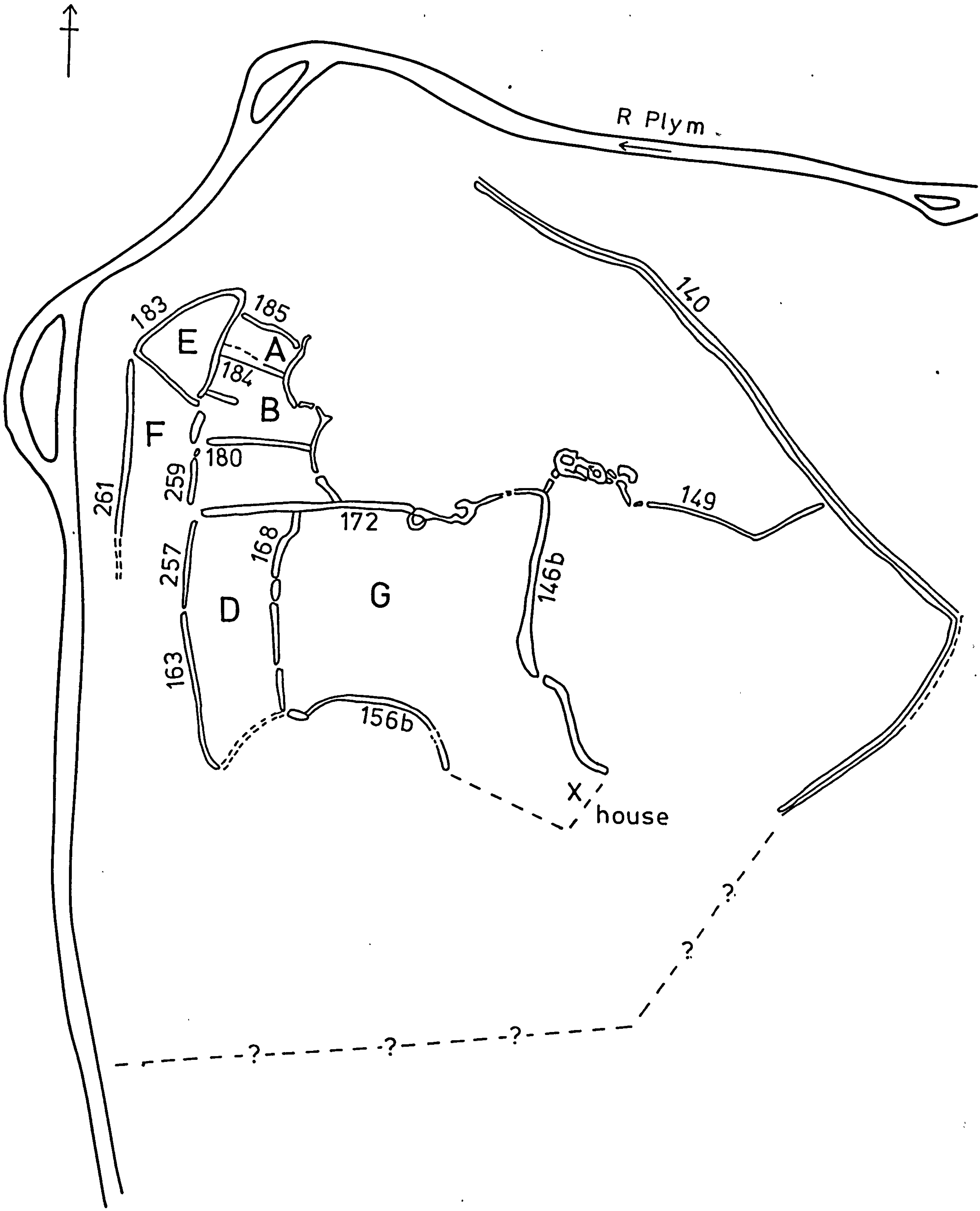


Fig. 3:3 Trowlesworthy field system Phase I:
early 13th century

the northern sector of this enclosure marked the southern boundary in the earliest reclamation of the field in the 19th century. (OS 6 inch 1887, 1906) Not until after 1904 was the present southern boundary and, by implication the coursed wall round the whole field, built. The coursed wall round the field, **Mon 183**, may also post-date 1904.

The West side of Fields A to D was probably defined by one continuous boundary, consisting of the East side of the field, **Mon 183**, walls, **Mon 181**, **Mon 259**, **Mon 257**, and the West side of the field, **Mon 163**. The walls, **Mons 181**, 259 and 257, are of similar construction, consisting of large stones and boulders contained within a low mound. Any large stones in the, now, earthen banks of the early phase of the fields, **Mons 183** and 163 might have been appropriated for the 20th century wall, which in **Mon 163** in particular, consists of a boulder base topped with smaller stones. The boundary either deteriorated or was partly dismantled by the warreners, possibly to facilitate trapping. For example, one gap in the boundary between elements, **Mons 259** and 257, is "covered" by a vermin trap, **Mon 258**.

The East side of Fields A to C is formed by prehistoric enclosures; thus the walls, **Mons 185** and 184 abut the western sector of enclosure, **Mon 175a**, and the wall, **Mon 180** abuts the western sector of the enclosure, **Mon 173a**. The boundary, **Mon 172**, cuts through the South sector of the enclosure, **Mon 173a**, and contains large boulders and orthostats, which were presumably robbed from the now barely visible southern arc of the enclosure. The northern boundary of Field A, **Mon 185**, may also be a modified prehistoric enclosure. It contains inner and outer facings, similar to prehistoric construction.

The western extent of the field system is not entirely clear. It is possible that the lowest boundary, **Mon 261**, nearest the R. Plym, encloses another field below and parallel to Field F. However, this boundary, **Mon 261**, may be more likely to have been associated with tinworking; the wall of boulders and tumbled stone appears to continue to the North along the R. Plym beyond the fields, while fragments are also visible further South among tinners' waste heaps. Therefore, the western boundary of Fields E and F, curving round the slope completes a neat parcel of fields.

The plan of the larger field, G, depended to a great extent on the position of the pre-existing prehistoric enclosures. Thus the boundary, **Mon 172**, continues eastwards after cutting through the enclosure, **Mon 173a**, and cuts through the South sector of the enclosure, **Mon 174a**, incorporating, apparently with little modification,the hut-circles, **Mons 174d** and **174c**. The boundary, **Mon 146b** and **a**, defines the East side, incorporating the western sector of the enclosure, **Mon 148a**. It was noted above that the northern sector of the enclosure, **Mon 156a**, defined the southern boundary of Field D. Similarly, the North sector of **Mon 156b** was in use as a boundary in the late 19th century, and, therefore, perhaps also in the earliest period of Medieval settlement, though, again, it was not recorded in the 1840's. (OS 6 inch 1887; WDRO MFC 710; 710/203) A fragment of a bank, **Mon 157**, of similar earth and boulder construction as the other Medieval boundaries is superimposed on the northern apex of the enclosure, **Mon 156a**. This may have been part of the Medieval refurbishment of the prehistoric boundary, though was later truncated by the post-1904 coursed wall. The southern boundary of Field G may then have continued along the route of the North side of the field, **Mon 130a**, and the NW side of the yard, **Mon 130e**. Field G would then be completely enclosed. (Haynes Map TRO)

It is likely that all these fields were constructed as part of a single phase. The common boundary, **Mon 172**, between Field G and the smaller fields to the West, provides a strong chronological link between them. The continuous earthen boundary in **Mon 183** suggests that Field E was completely enclosed in a single phase and, therefore, contemporary with Fields A and B. The only possible internal sequence might be the later construction of the boundary, **Mon 168**, which abuts the boundary **Mon 172**. This might imply that Field D was created out of the West part of Field G, after the initial phase of settlement. However, this is not conclusive.

Associated with the field system must be the house, which was "taken down" in the 1800's and finally destroyed in the 1930's, but recorded by Haynes at **Mon 130f**, connected to the boundary running between another boundary, **Mon 146a**, and the field, **Mon 130a** (WDRO 710/751; Haynes Map TRO 47) A sketch plan, drawn *c.* 1842 by Henry Woollcombe, shows a two-storey longhouse, consisting of a "barn and turf house" at the South end, a central "entrance room" and a kitchen at the North end with a stable attached to its East side. (WDRO 710/751) (See Fig. 3:4)

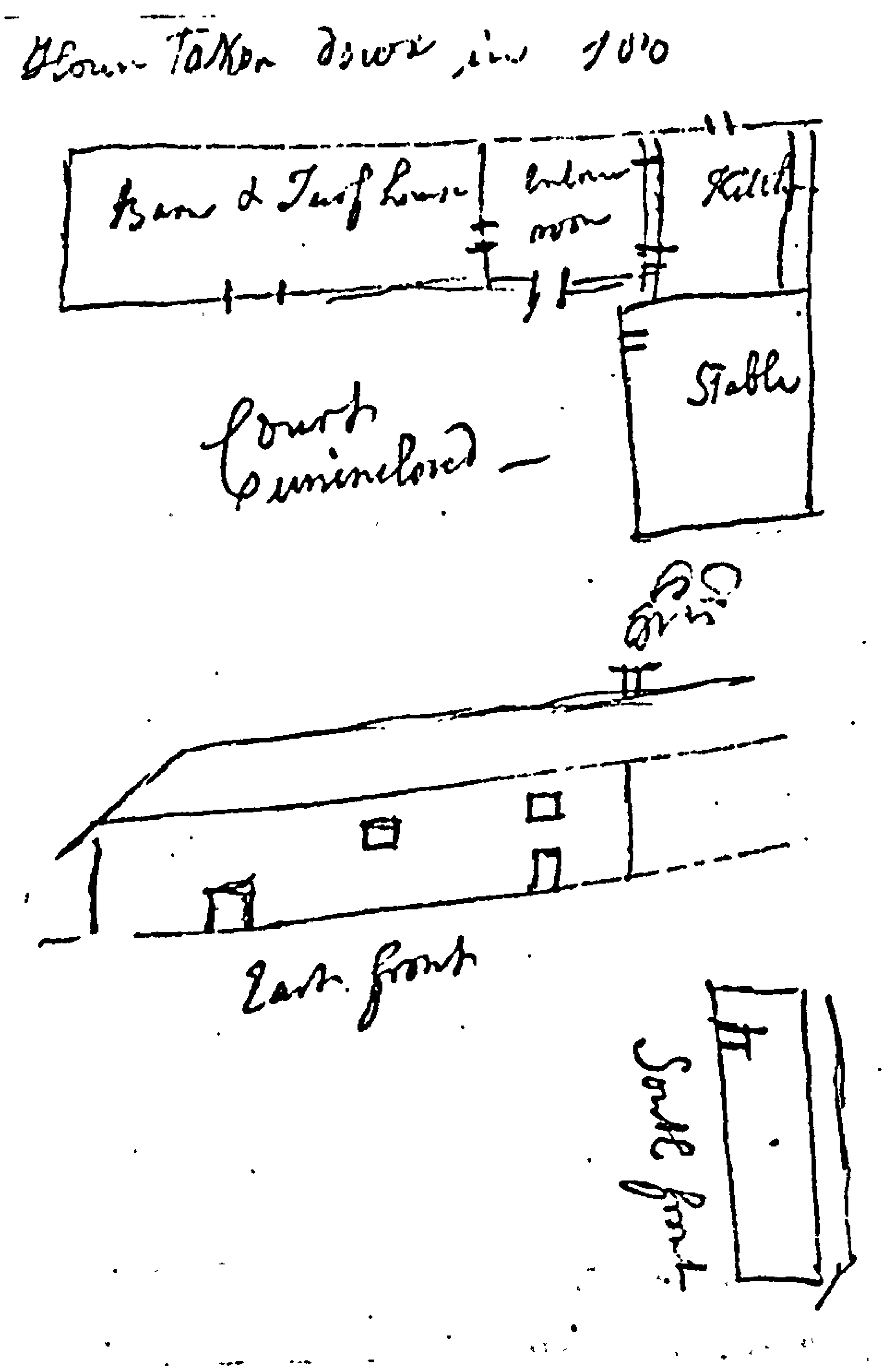


Fig. 3: 4 Sketch of the early house at Trowlesworthy (from Henry Woollcombe's notebook WDRO 710/751)

At some stage, a corn-ditch, **Mon 140**, was constructed to the East of these fields. L-shaped in plan, it virtually encloses the spur above Shadyback Tor. The NE boundary, **Mon 140b**, almost reaches the R. Plym, while the SE boundary ,**Mon 140a**, might have originally continued to the SW, possibly along the route of the South side of the field, **Mon 130a** to the R. Plym. Thus, with the R. Plym on the N and W, the whole area would be enclosed.

The relationship between this boundary and the fields to the W cannot be firmly established. A connecting boundary, **Mon 149**, abuts

Field G, but the truncation at its East end at the corn-ditch, **Mon 140b**, may be a result of warrening modifications rather than the original relationship. The large-scale uninhibited nature of construction contrasts with the careful recycling of pre-existing enclosures further West. This might suggest that the corn-ditch was not part of the same constructional phase, but the different character may alternatively reflect different function and/or different landscape. The only prehistoric feature, **Mon 139**, in the area was used as a landmark for the 90° turn. Thus this boundary could represent a later extension of enclosed land or the marking out of enclosed land, contemporaneously with the smaller fields or even earlier at the initial stage of occupation.

The 19th century pattern is illustrated in contemporary maps. (Fig. 3:5) These fields were in use in the early 1840's along with the present house, **Mon 130h**, and were probably enclosed by the mid-18th century. (See below p.257) (WDRO 710/203; MFC 710) **Mon 158** must have originally divided **Mon 130a** into two fields, H and I, and may also have continued to the N, where it was superimposed on the SE sector of the prehistoric enclosure, **Mon 156a**. The boundaries, **Mon 7** and **Mon 172/149**, are also recorded in 1842 and may therefore have been in use then. (WDRO 710/203)

A series of parallel walls, E of Shadyback Tor recorded on the "Rough Plan of Trolsworthy Warren" and labelled "The Fields", is more difficult to interpret. (WDRO 710/203) This may refer to fields formerly in use; the draughtsman depicted other landmarks of historical interest, such as "British villages" and "druidical temples". However, apart from the boundaries, **Mon 140b** and **Mon 195**, these walls cannot be identified. They may be a schematic representation of the Phase I fields.

Between 1842 and 1886, Fields E and D were reclaimed and a new series of fields is recorded to the East of the 1842 house and fields. (Fig. 3:6) (OS 6 inch 1887) This series was enclosed on the NE and East sides by a bank and ditch, **Mons 108a-c**. This boundary contains the elements of corn-ditch construction but the occasional large irregular stones on the NE side do not, perhaps, represent the facing of the true corn-ditch. The NW side was enclosed by a boundary, which has since been modified into a pillow mound, **Mons 134** and **135**. At present, a low bank, **Mon 108d**, closes the gap between the corn-ditch, **Mon 140** and the

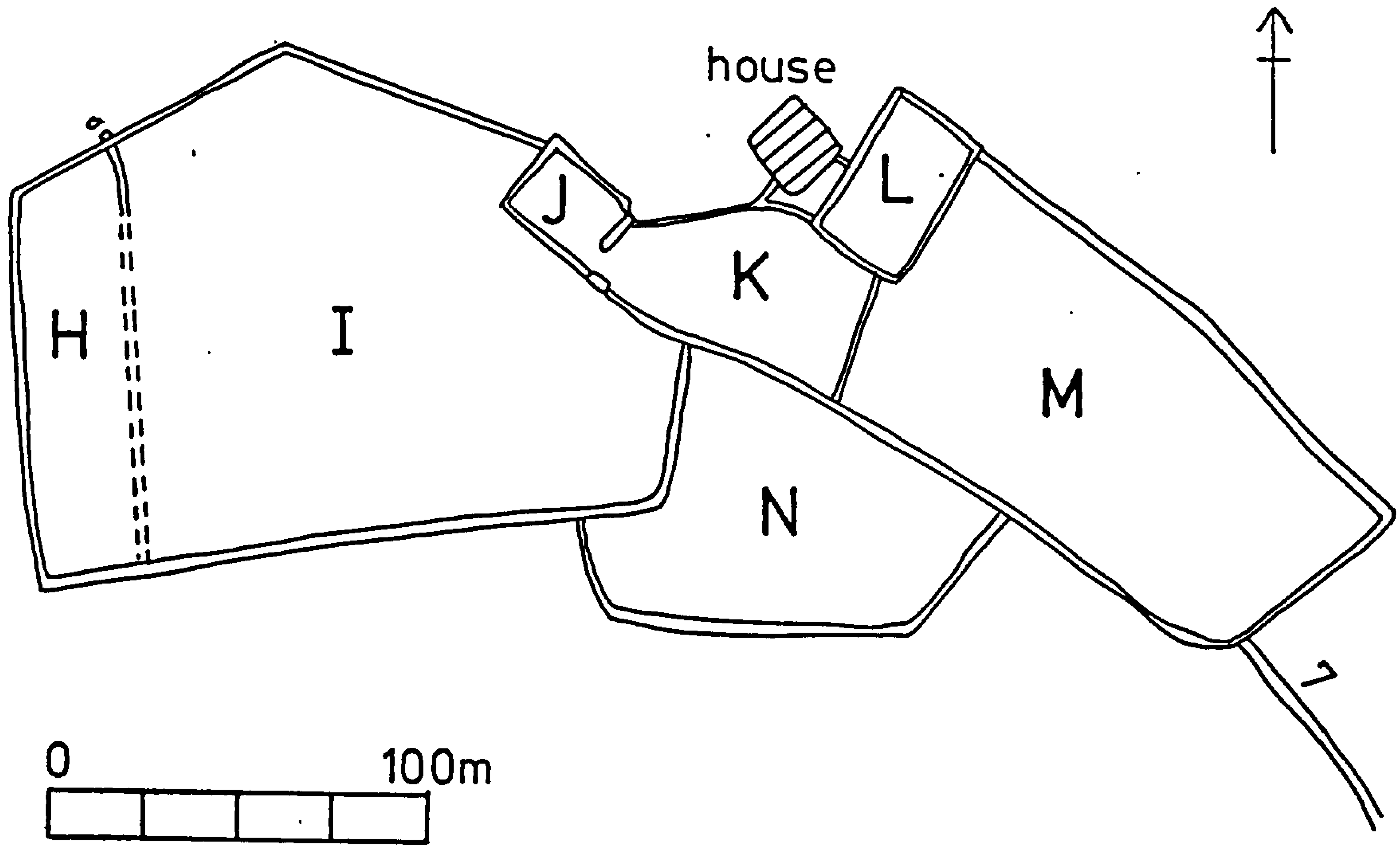


Fig. 3:5 Trowlesworthy field system Phase III: pre-mid 18th century

Field	Mon.	Field Name
H } } I }	130a	Little Meadow / Great Meadow
J	130b	Lower Garden
K	130j	Pond field
L	130i	Potato Garden
M	{130l {130m	Clover Field
N	130k	Carrion Stake

Information from Tithe Map and Rough Plan of Trowlesworthy (WDRO MFC 710; 710/203)

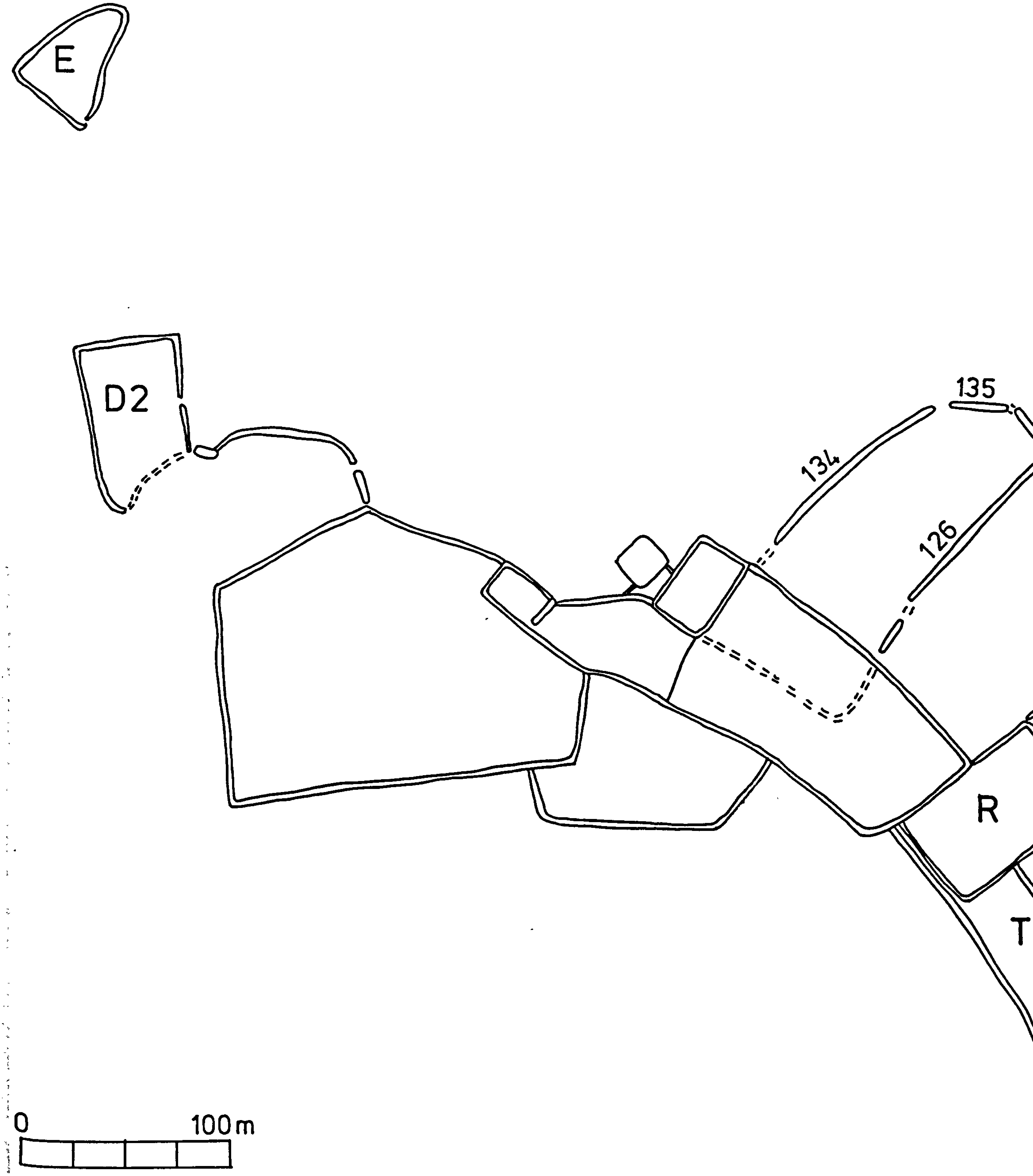


Fig. 3:6 Trowlesworthy field system Phase IV: 1886

135
126
108c
123
108b
R
S
T
115
114
U

bank and ditch, **Mon 108c**, and may have been built after 1904 when the 6 inch Map was revised, and probably only when the pot-water leat, **Mons 98b/121/137/141**, was out of use. (OS 6" Map 2nd. Ed. 1906) Previously, this flowed between the two boundaries, **Mons 140a** and **134/135**. The collecting tank, **Mon 136**, has been partly cut into the original NW boundary, dividing it into **Mon 134** and **135**. However, this may have been done at a later date, when the water supply was channelled into **Mon 141** for the water wheel and generator at **Mon 130g**. (Haynes Map TRO 11)

It may also be suggested that these fields were enclosed rather earlier than the period between 1842 and 1886. The pot-water leat is recorded in 1825 and may be considerably earlier. The South end of the boundary bank and ditch, **Mon 108**, appears to be integral with the roughly coursed wall, **Mon 7**; the latter was recorded in 1842, and, therefore, suggests that **Mon 108** also pre-dates 1842. (WDRO 710/203)

The boundaries, **Mons 134**, 126 and 123, differ greatly morphologically from those of the presently maintained fields and do not resemble boundaries first built between 1842 and 1886. They also differ morphogically from **Mons 7** and **108**, which might suggest that the latter follow the routes of older boundaries. **Mon 134** has been enlarged into a pillow mound and its original form is undetectable. However, **Mon 126** is a single line of very large boulders and may correspond with Fleming and Ralph's "block-wall" (1982, 106), and **Mon 123** consists of a turf bank containing some small stones, similar to those in the western group of fields.

Furthermore, the 1887 Map indicates a sub-division of Field M, which clearly relates to Field O. (OS Map 6 inch 1887) This suggests that the 1842 pattern was imposed on, and to a certain extent dictated by, an earlier pattern. (Fig. 3:7) Thus Field M partly cut across Field O, but may have taken advantage of a southwestern continuation of the boundary, **Mon 123**, which originally joined **Mon 7**. Two later fields, R and S, have been clearly set into an older pattern; new walls were built inside **Mon 7** at the SW side of Field R, and inside **Mon 114** at the SE side of Field S. These late fields, R and S, may have been designed for stock; the deceptively flimsy construction, in which many gaps are visible between irregular stones, deters sheep from attempting to climb over.

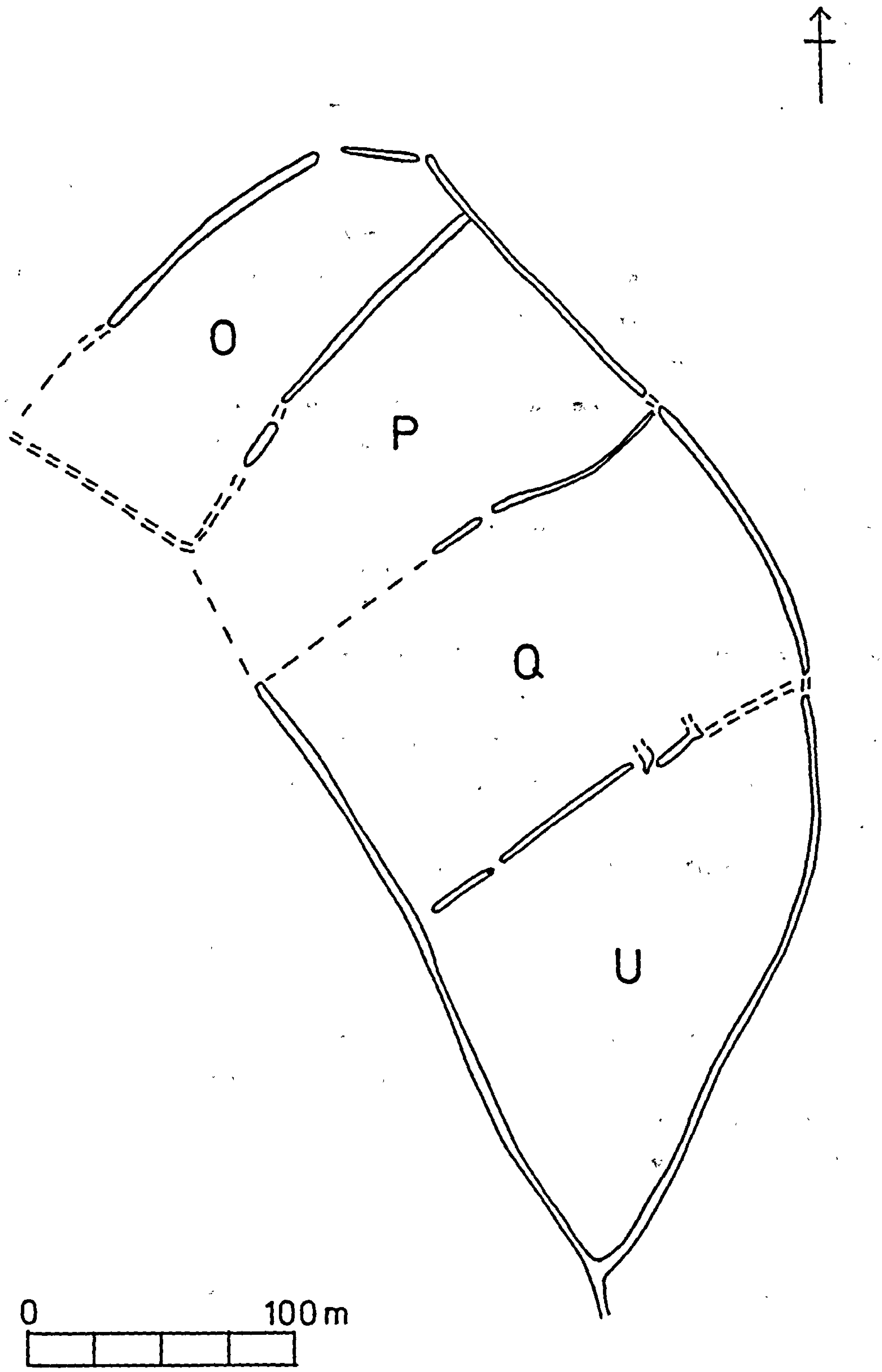


Fig. 3:7 Trowlesworthy field system. Phase II : post 13th. Century

These eastern fields may represent an intermediate stage between the earliest settlement to the N, and the 18th and 19th century concentration on the presently-maintained fields. The shift eastwards may have been a response to a desire for large fields, less cluttered with prehistoric remains, but also to escape from interference by tin streamers.

b) Spanish Lake

Spanish Lake Farmstead, **Mon 543**, is situated close to the E bank of Spanish Lake, on the course of the Willings Walls reave, **Mon 540**. A stretch of 50m of the reave has been demolished, and probably provided building material. The farmstead consists of a two-compartment longhouse, a possible earlier longhouse and a small yard and is depicted in fig 3:8 and described in detail in App. F. The absence of any field system suggests a concentration on pastoral activities and there is evidence of stock control in the vicinity, though its association with Spanish Lake farm cannot be demonstrated.

It is possible that the gullies, **Mons 568** and 557, running through the Willings Walls reave to Spanish Lake, are holloways, which provided access for livestock on the moorland above, to the water supply. A gully forms an effective droveway by deterring livestock from straying to either side. Both seem to be contemporary with the reave but may have been utilized and adapted at a later date. (See App. F: **Mons 540, 557** and **568**) Thus, at some stage, a substantial earthen bank and ditch, **Mon 479**, corresponding to a "hedge-bank", was constructed to the E of the reave, running from the gap at **Mon 540c**, to the Cholwich Town reave, **Mon 480**. At this stage, the Willings Walls reave, N of the gap, **Mon 540c**, may have been refurbished; here it is closer morphologically to the hedge-bank, **Mon 479**, than to the southern part of the reave, and is provided with a ditch, which continues almost to Hentor Brook. Contemporary with the hedge-bank must be the eastward extension of the holloway, **Mon 557**, though the latter reaches the bank at a relatively narrow opening. A gap was left at **Mon 540c** to allow access for the gully, **Mon 568**. A rectangular enclosure, **Mon 565**, attached to the W side of Willings Walls Reave may also have been associated with these.

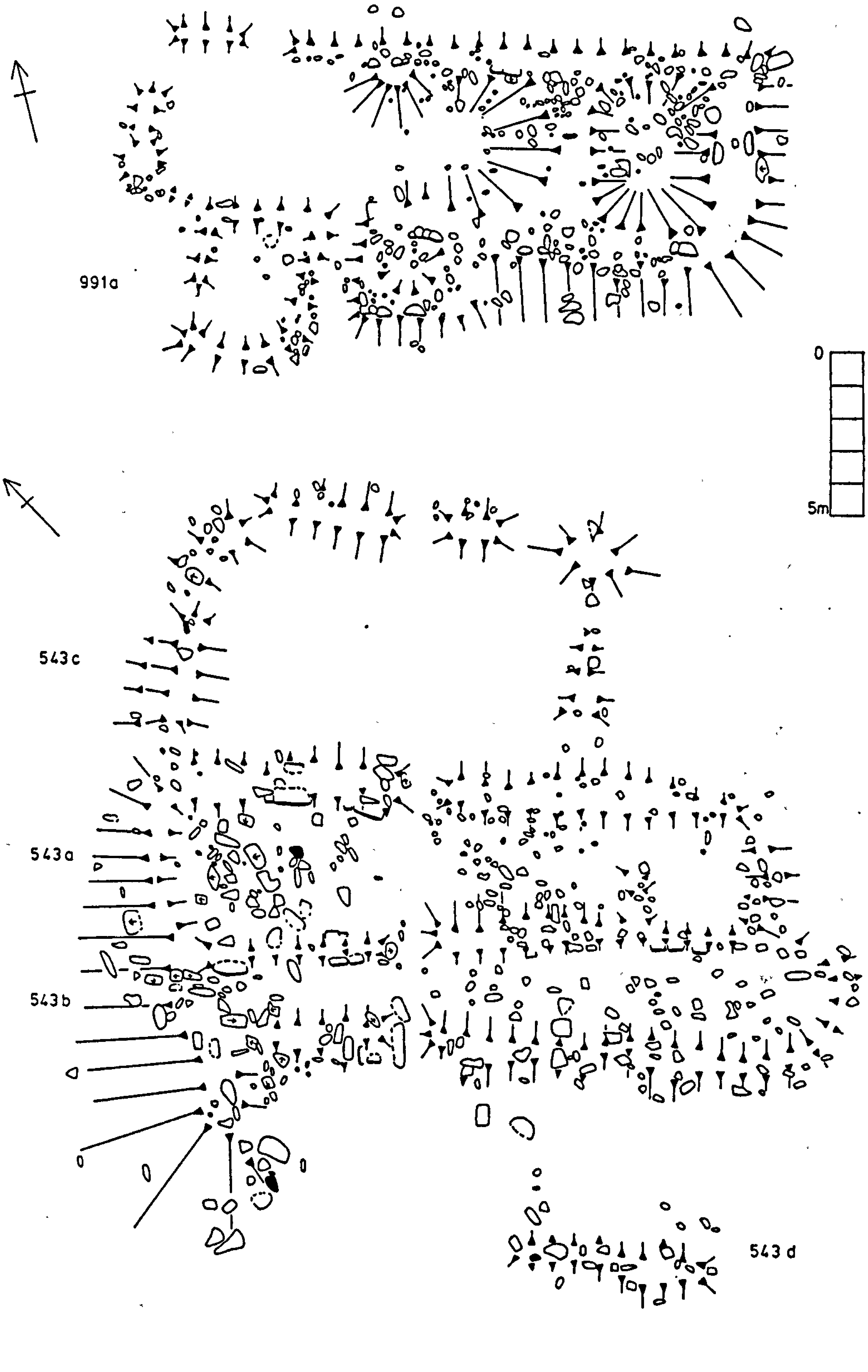


Fig. 3:8 Spanish Lake farmstead, Mon 543 and Shavercombe Foot farmstead, Mon 991

While the hedge-bank, **Mon 479**, may be Medieval, it is not clear how this bank and the reused gullies relate to Spanish Lake Farmstead. It may be significant that the holloways do not lead to the farmstead. It is possible that the bank was built to replace Willings Walls Reave when the latter became partly submerged in raised bog. The necessity for a Medieval replacement of the boundary suggests that the prehistoric division between the lower valley and the upland, marked by the contour reave was still valid in the Medieval period. Therefore. it is possible that Spanish Lake Farmstead represents the lower valley occupation, which was kept separate from the upland. The latter may have been used as summer pasture by in-country farmers. Therefore, the holloways provided a route for livestock to the water supply, without disturbing Spanish lake farmstead. However, the bank is not necessarily contemporary with Spanish Lake; it may simply have been built to keep livestock away from the boggy area and peat cuttings, either before the farmstead was built or after it was abandoned.

However, if the provisions for stock control were not directly associated with the farmstead, pastoral farming must still have been the main occupation. There is a further possibility that this was supplemented by warrening. A series of pillow mounds, **Mons 394, 396-7, 536-9** and **X6**, was constructed along the E bank of Spanish Lake and a further one, **Mon 542**, was built immediately adjacent to the farmstead. However, association with the farmstead is perhaps unlikely. Willings Walls Warren was included in Hentor Warren, when the latter was leased, probably for the first time as a warren in 1807. (see below p.264) (WDRO 582/11/2) The pillow mounds may, of course, predate this. However, it is shown below that warrening was not introduced to Trowlesworthy and Ditsworthy until the mid-17th century and it is unlikely that warrening began at Spanish Lake before this, yet the remains of the longhouse suggest an earlier date.

c) <u>Willings Walls</u>

Willings Walls settlement, **Mon 593**, is situated within a group of interconnected prehistoric enclosures, **Mons 585 - 592**, on the gently-sloping northern spur of Willings Walls Warren. The settlement consists of a single-compartment rectangular building, Mon 593a, surrounded by three yards, Mons 593b - d.

It might be assumed that a single building, associated with yards and a water supply, Mon 584, represents the dwelling of a farmstead. The absence of an associated field system or traces of cultivation rules out arable farming but a pastoral economy is still a possibility; the prehistoric pounds could have been reused for the enclosure of livestock. However, the size and morphology of the house suggests that this is not a permanently-occupied farmstead. Only 6.50m long internally, and with a single entrance at one end, the house is quite distinct from the combined dwelling and byre of the typical longhouse. The house compares in size and plan with some outbuildings, but is significantly smaller than other houses in UPV.

Morphology and the good state of preservation suggests a relatively late date. The neatly-built coursed masonry of small regular stones survives up to a height of 1.30m. Presumably building material was quarried from the adjacent prehistoric enclosures. The yard, Mon 593b, attached to the SE wall of the house is composed of similar coursed masonry of small stones. The other yards, Mons 593c and d made good use of the prehistoric enclosures, Mons 586a and 588a.

d)<u>Hentor</u>

Hentor Farmstead is situated on a gently-sloping plain to the NW of Hen Tor and consists of a compact group of buildings and yards. The well-preserved 17th century Hentor House, Mon 910n, may have been preceded by an earlier dwelling. Associated with the farmstead are two separate field systems belonging to two different periods of occupation. To the S, a small series of irregularly-shaped fields, directly adjoining the farmstead represents the earliest phase and may have been associated with the earlier dwelling house. (Sheets 9, 10, 16 and 17) The extensive field system of large regular fields, laid out further N and almost reaching the R. Plym, is probably associated with the later house. (Sheets 16 and 17) An earlier longhouse, Mon 975, incorporated in the northern field system is discussed separately. (see below p.129)

The two field systems are separated by a marshy area surrounding a tributary of Hentor Brook. Following local tradition, Hemery (1983,202-3) applies the term "Hentor Brook" to this small tributary, preferring "Willa Brook" for the main stream. However, to avoid confusion, the terminology on OS Maps is retained.

Later, the farm was operated as a warren and pillow mounds and vermin traps provide evidence for this period. The Phillips Leat, **Mon 520**, constructed in the 1830's, runs directly past the farmstead and cuts across both field systems. It thus provides a *terminus ante quem* for all but one of the boundaries.

The S field system occupies the margin of prehistoric settlement at Hen Tor. The enclosure, **Mon 533**, and the hut circle, **Mon 913**, have been incorporated in the field system, while the vestigial curving boundary, **Mon 911**, just visible on the W side of the farmstead, may be the remains of a prehistoric enclosure. However, most of the prehistoric occupation lies further S in the area of densest clitter.

The S field system consists of a very irregular series of fields, enclosed by boulder and rubble walls. These boundaries are probably a result of clitter clearance and correspond to Fleming and Ralph's "clearance-walls". (1982, 106-7) It is even possible that the irregular plan is a result of the clitter distribution as clitter tends to be deposited in rough lines or "streams". Thus the irregular intervals between the internal walls might be produced if these "streams" were simply piled up into walls. The four western fields still contain a considerable amount of clitter, which, therefore, must have precluded cultivation.

The outer perimeter, at least, seems to have been constructed in a single phase. The N and S boundaries, **Mons 577** and **519**, consist of continuous clearance walls, the two gaps in the S boundary not necessarily implying any sequence of construction. The SW end of the S boundary is interrupted by a tinners' gully. The very irregular course of the N boundary seems to define the marshy area to the N. The wall follows exactly the southern outline of the marsh, known as Hentor Meadow, depicted on the 1st edition of the OS 6 inch Map. (1887) This area, to the S of the tributary, may have become more marshy since the tributary was disturbed by Phillips Leat, Mon 520. However, meadows, which were traditionally devoted to hay-making, were often characterised by seasonal flooding. (Beds. Co. Co. 1985, 40) Whether or not hay was ever cut here, the "verdant mixture of wet and dry ground" seems to meet the requirements. (Hemery 1983, 202) It was known as a meadow at least by the early 16th century; a tinwork called "Hyndtormeade", which presumably refers to the streamworks in the adjacent Hentor/Willa Brook was recorded in 1529. (WDRO 72/990/15) Therefore, the area may have been wet when the wall was built.

Internal boundaries, Mons 521, 523 and 524, may have been added later and at different times. They abut the N and S boundaries at irregular intervals and enclose fields of varying shapes and sizes. Mon 534a may have joined up with Mon 909 to form a small sub-rectangular enclosure with Mon 534b and part of Mon 910a around the outbuilding, Mon 910c, but this has been damaged by the Phillips Leat and is difficult to interpret. (Sheet 17) The easternmost field, between the boundaries, Mons 534a and 915, contains the least clitter, and is partially subdivided, though for no obvious purpose. A curvilinear, vestigial boundary, Mon 914, almost separates the N end of the field and two parallel poorly-preserved walls, Mons 532 and 531, define two narrow strips parallel to Mon 534a.

At some stage, the N field system was laid out; this must have been necessitated by a desire for more arable ground. Opportunites for cultivation must have been very limited in the existing clitter-strewn fields to the S, and the wet area of Hentor Meadow precluded the construction of a field system immediately to the N of the farmstead. Therefore, a new field system was built on the well-drained, clitter-free slopes further N on Hentor Plain. Originally this N-facing slope may have been less desirable than the relatively sheltered site on the southern part of Hentor plain, while the E end was possibly already occupied by Shavercombe farmstead, Mon 975.

There is a remote possibility that the farmers were also attracted by a pre-existing field boundary. The Willings Walls Contour Reave, Mon 540, can be traced from the head mire of Spanish Lake, round Willings

Walls to Hentor Plain. E of Hentor Brook, the reave was utilized and refurbished by the Medieval farmers. It followed a NNE course for 280m, and then the Medieval boundary turns sharply eastwards through an angle of 54° at **Mon 540f.** Fleming and Collis (1973, 3-5) suggested that the reave continued to the NNE across the R. Plym from the change in alignment at **Mon 540f.** The alternative possibility that the reave underlies the Medieval boundary, which continues in a northeasterly direction to Shavercombe Brook (the "reave-extension") was discussed above. (See p.20) It was also suggested that other reaves may underlie some of the Medieval/Post-Medieval boundaries, which define the rectangular fields on either side of the reave-extension.

Regardless of possible antecedents, the layout of the N Hentor field system is still a major undertaking. About 23 large rectangular fields are enclosed on either side of a central spine formed by the reave-extension. The original plan has been slightly modified by later activities; Phillips Leat, **Mon 520**, clips the SE corner, while pillow mounds have been built within fields and on top of boundaries. The drain **Mon 836**, which sub-divides the field, **Mon 835a**, and the banks, **Mons 931b** and **928e**, may also be later additions by warreners.

Traces of cultivation are visible to varying degrees from the air in most of the fields. (**Mons 838a, 839, 841a, 847, 928a, 930a, 931a, 932a, 934a, 965a, 966a, 969a**) In fields, **Mons 847, 932a** and **934a**, eleven furrows can be detected, set 3.50m-4m, 4.60m and 4.50m apart respectively. In fields, **Mons 965a, 966a** and **969a** six furrows can be seen, 6m, 6.50m and 6.50m apart respectively. The traces are too fragmentary in the remaining fields to assess the number of furrows.

Lynchetting is evident in the fields to the N of the reave-extension. The northern perimeter is defined by boundaries, **Mons 835c, 840c, 841c, 843** and **848**, which now appear similar in construction to corn-ditches. However, in each case, only the external side of a dry-stone wall of coursed masonry is clearly visible. The inner sides within the fields are now mostly masked by a considerable accumulation of soil. For example, at the boundary, **Mon 843**, the top of the wall merges with the present ground surface within the field, but drops 1m in height to the N. The build-up of soil may be a result of cultivation combined with natural soil creep, though it does not necessarily account for the full 1m. The discrepancy in wall height may be exaggerated by the steepness of the slope and the revetment is probably partly built into the hillside. Lynchets do not appear to have developed in the fields, to the S of the reave-extension probably because these fields lie on a rather gentler slope.

Dense heather cover masks many of the remaining boundaries, but most seem to consist of a matrix of earth and stone. The stone content varies from a minimal amount in **Mons 930b, 931b, 932c, 934b, 934c** and **933b** to a quantity of large irregular stones in **Mons 930c, 932b** and **932d**. The only other variations from this type of construction are corn-ditches, **Mons 928b** and **c** and **Mons 923a** and **924** and a substantial dry-stone wall, **Mon 838b**.

However, morphology does not reflect chronology. Thus corn-ditches seem to be integral with earth and stone banks. For example, **Mon 835c** is integral with **Mons 835b** and **835d**, **Mon 843** is integral with **Mons 841b** and **845b**, **Mon 848** is integral with **Mons 965b, 965c, 966b** and **969b**, and finally **Mon 928c** is integral with **Mon 928d**.

Horizontal stratigraphy is equally unhelpful in extricating a chronological sequence. An attempt was made to establish the stratigraphic sequence following the principle of the Harris-Winchester matrix. (Harris 1975, *passim*) Relationships between individual elements of the field system were assessed. Thus integral boundaries were considered to be of equal date, a boundary, which abuts another is later and a boundary, truncated or superimposed by another is earlier.

As the reave-extension is considered to be a single monument, it has only one survey number. However, the refurbishment associated with the construction of the field system has divided the reave into separate elements. Thus for the purposes of this exercise, each element of the reave was given the number of its adjacent field, for example, R840a. Where the reave element appears to continue along more than one field it is numbered accordingly, for example, R965a/847/845a.

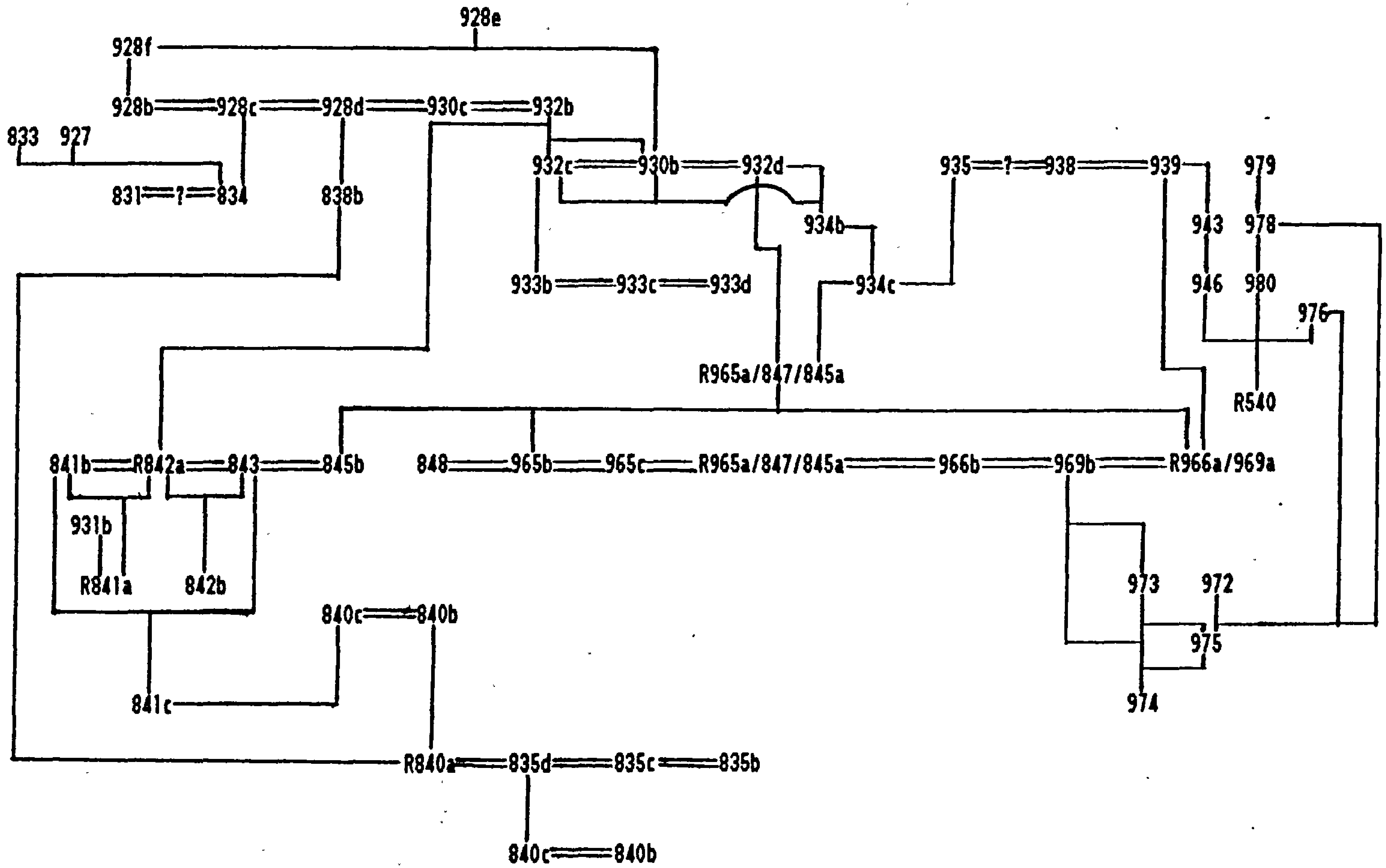
The stratigraphic sequence is illustrated in Fig 3:9. The numerous stratigraphic relationships demonstrate that there have been different phases of construction; but the lack of a logical pattern suggests that this sequence is one of refurbishment rather than the original construction. In one example, horizontal stratigraphy contradicts a sequence implied in the overall plan. Thus, according to stratigraphy, the truncation of **Mons** 933b and d indicates that the field **Mon** 933a is earlier than the fields, **Mons** 932a and 934a, but the overall plan suggests the reverse sequence. The present relationship could have resulted in the later modification of the fields, **Mons** 932a and 934a.

However, periodic refurbishment is not enough to explain ambiguities. Thus, according to horizontal stratigraphy, the reave extension element, R965a/847/845a truncates two boundaries, which are apparently contemporary with it, while **Mons** 840c and 840b appear to be both earlier and later than one series of boundaries. Integral junctions and superimpositions or abuttals must represent the true chronological sequence; therefore, a possible conclusion is that apparent truncations do not. Thus gaps could result from later damage, for example, by warreners, or could have been provided at the outset as entrances. It is also possible simply that the provision of a continuous boundary was unimportant in refurbishment.

Nevertheless, some general comments can be made. Thus, the topmost layer in Fig. 3:9 represents the only boundary, **Mon** 928e, which is later than Phillip's Leat, **Mon** 520. It is superimposed on the bank, but respects the leat and, therefore, must date between 1833 and *c.* 1879. (Haynes 1976, 259; Haynes Map TRO) It also appears that the fields to the S of the reave-extension are later than those to the N. Thus internal boundaries all abut or are superimposed on reave elements refurbished in association with the northern fields.

It is not clear when several walls in the area between the farmstead and the northern field system were built. An area to the S of the northern field system has been enclosed by a corn-ditch, **Mons** 923 and 924. This may be contemporary with the field system, forming its southern boundary, though it does not completely enclose the area. A block wall, **Mon** 920, seems to continue the boundary westwards, but then

Fig. 3:9 Matrix analysis of Hentor field system



disappears in a marshy area. The origin of the block wall is uncertain; it appears to follow the original course of the tributary. Morphologically early, the block wall may pre-date the corn-ditch.

The field, defined by the stone walls, **Mons** 912a - d, has clearly been added to the farmhouse, **Mon** 910n, and is, therefore, associated with the late 16th / early 17th century developments. It is possible that this was an early attempt at an extension of the southern field system but was found to be too wet, making further extension to the N necessary. Alternatively, part of this wet area may have been deliberately enclosed as a meadow. A dry-stone coursed wall, **Mon** 919, abuts this field and the block wall, **Mon** 920. Its purpose is not clear; it may represent an attempt to link the northern field system to the farmstead and might even have been intended as a walkway across the marshy Hentor Meadow.

Hentor Farmstead

Hentor farmstead is the most complex Medieval / Post-Medieval settlement in UPV and contains a large number of buildings, which have been interpreted with the help of Mr. Harry Gordon Slade.(fig 3.10) The farmstead is enclosed by a wall. **Mon** 910a, on the W side and by a long series of buildings, **Mons** 910m, n, o, p and q, on the N. The E side is now defined by Phillips Leat, **Mon** 520, which was built in the 1830's, by which time the farm had been abandoned. However it is suggested that, from the tributary of Hentor Brook to the farmstead, Phillips followed an earlier pot-water leat, which had provided the water supply to the farm, possibly from this tributary or, as Hemery suggests, ultimately from Shavercombe Brook. (Hemery 1983, 200) Therefore, a leat may always have defined the E side, as at present.

The main dwelling, **Mon** 910n, is of particular interest. It is best described as a two-cell lobby entry house, in which the entrance opens in front of the dividing wall between the two compartments. Harry Gordon Slade suggests (*in litt.*) that this wall is of a thickness (1.60m), which could have "supported a straight-flight mural stair to an upper floor". However, normally the dividing walls of lobby-entry houses contain a fireplace and chimney stack (an" axial stack") and a similar arrangement here may explain the great width of the wall. (Child 1990, 44; Mercer 1975, 61-2) In this case an upper floor could have been

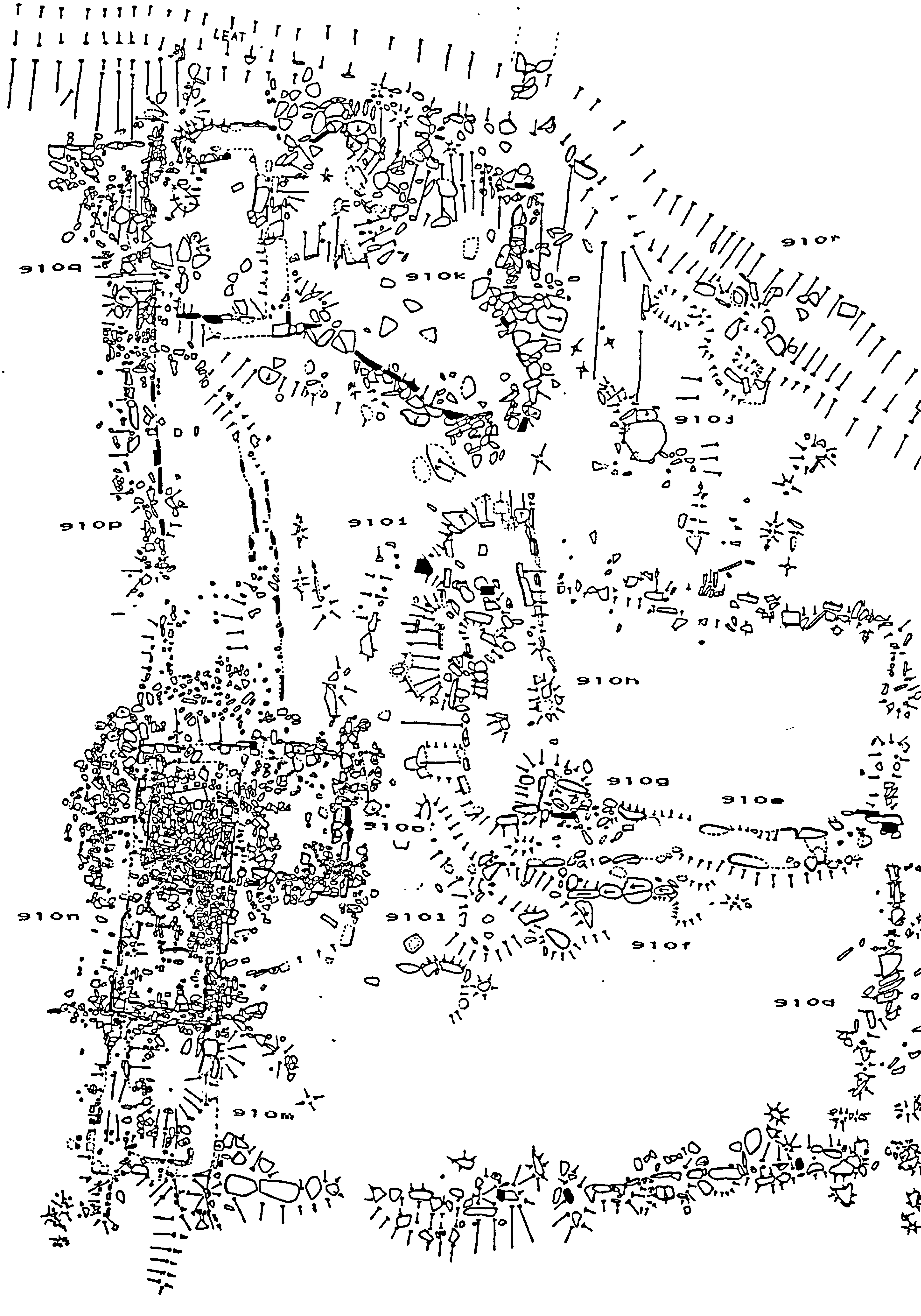
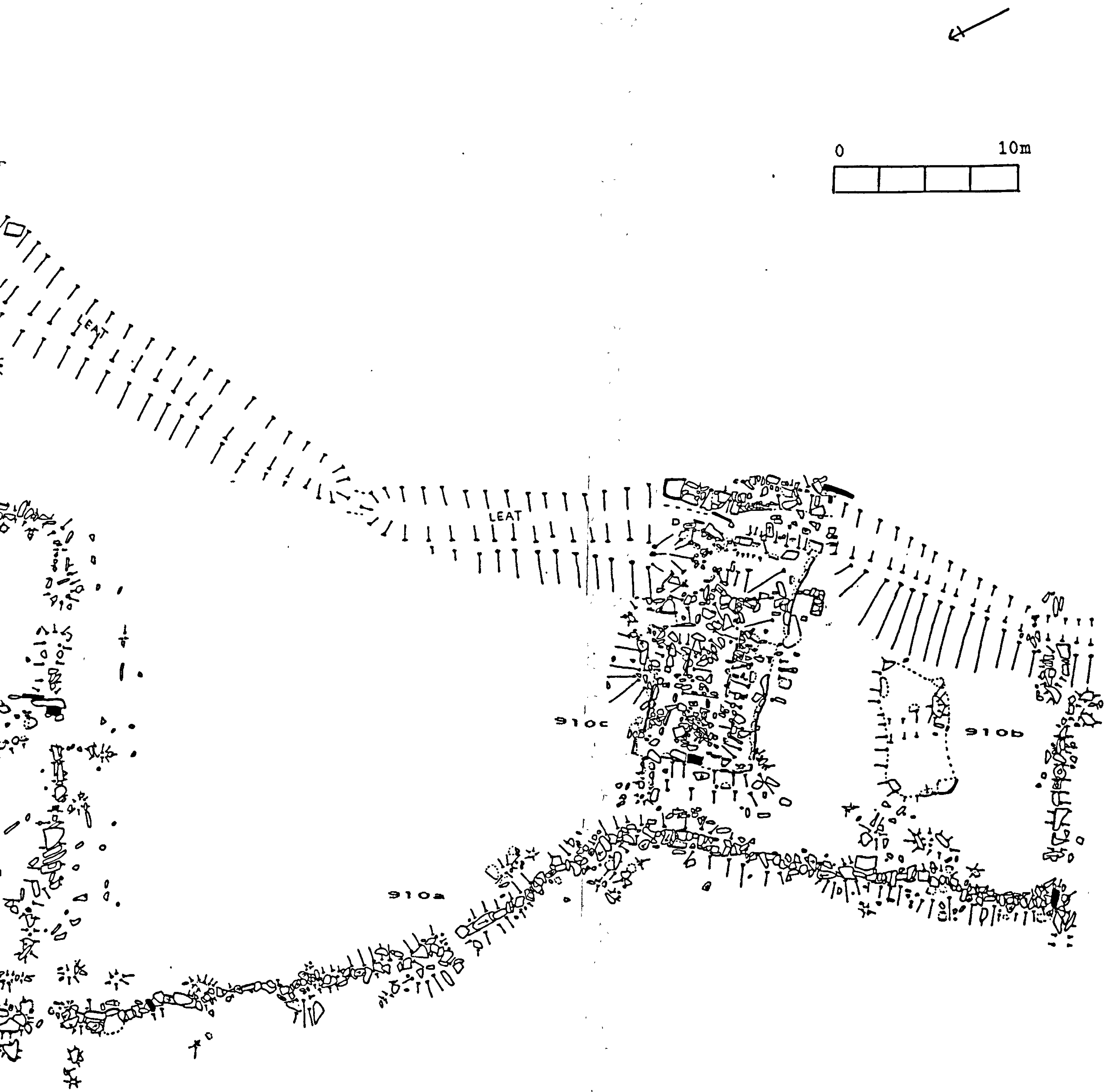


Fig. 3:10 Hentor farmstead


0
10m
LEAT
LEAT
910c
910b
910a

reached by a staircase against the axial stack. (cf. Mercer 1975, Figs. 43, 45 and 108) The chimney breast lying in the rubble affirms the former existence of a fireplace in the E compartment, though its location near the eastern end supports a position in the E gable wall. (H. Gordon Slade *in litt.*) The byre, **Mon 910p**, adjoining the eastern end may date to an earlier occupation of the site, associated either with a dwelling beneath the main house, or possibly with the house, **Mon 910q**, further E.

Hentor farm is further distinguished by the number of identifiable ancillary structures, including a haymow, **Mon 910j**, a shippen, **Mon 910f**, a kennel, **Mon 910g** and a large horizontal slab, **Mon 910h**, interpreted as a cool store (Hemery 1983, 200), a loading platform (Price 1980, 86) or a rick stand (H. Gordon Slade *in litt.*). At the S end of the farmstead are a windstrew, **Mon 910b**, and a single-compartment cross-passage structure, **Mon 910c**, interpreted as a mill, possibly driven by the original pot-water leat. Two other structures, outside the farmyard, are probably associated with the farmstead: a small very dilapidated single-compartment structure, **Mon 908**, to the W of the mill may have been a barn or labourer's dwelling and the crudely-built three-sided structure, **Mon 916**, to the E of the farmstead may have been some sort of animal pen. All these structures are described in detail in Appendix F.

e) <u>Shavercombe</u>

Shavercombe Farmstead, based on the longhouse, **Mon 975**, is situated to the N of Shavercombe Tor, at the E end of the large, northern field system, associated with Hentor Farm. The two-compartment longhouse is described in detail in App. F. It is partly superimposed on a sub-circular, presumably prehistoric enclosure, **Mon 974**, which is only clearly visible from the air. The farmstead seems to pre-date the Hentor field system, but its later incorporation in the latter hampers identification of any original enclosures.

The longhouse is abutted on each side by boundaries, **Mons 972, 973, 976** and **978**. It seems unlikely that a field system would be constructed with a longhouse at the intersection of four boundaries. Therefore, it may be suggested that not all of these are contemporary; the longhouse, probably in a ruinous condition, could simply have been used as a landmark in the enclosure of the later field system.

An area of rig and furrow, **Mon 970**, is visible from the air to the west of the longhouse. This rig and furrow, running along the slope, in contrast to the cross-contour ploughing of the Hentor field system is almost certainly associated with the farmstead. Therefore, the two boundaries, **Mons 972** and **973**, which define this area of cultivation may be contemporary with it. Furthermore, horizontal stratigraphy suggests that the SE boundary, **Mon 973**, pre-dates the Hentor field system; the easternmost boundary of the latter, **Mon 969b**, has been partly dismantled, but, seen from the air, it clearly curves southwards as if to avoid the boundary, **Mon 973**.

The other two boundaries, **Mons 976** and **978**, may then have been constructed as part of the Hentor field system, in an attempt to incorporate this easternmost end of Hentor Plain. Stratigraphic relationships confirm that these boundaries are late; thus the boundaries, **Mons 976** and **980** (which is abutted by **Mon 978**) abut the easternmost element of the reave-extension. (See Fig 3:9 R540) The latter abuts and is therefore later than the reave-extension associated with the fields further W. (See Fig 3:9 R966a/969a) Therefore, the enclosures shown by Linehan (1966, 118) and Price (1980, 85) were not originally associated with the longhouse.

f) <u>Shavercombe Foot</u>

Shavercombe Foot Farmstead, **Mon 991**, is situated, surrounded by tin workings, on the right bank of Shavercombe Brook, near its confluence with the R. Plym. The name "Shavercombe Foot", chosen by Linehan (1966, Table II No.104) is perhaps not sufficiently distinguishable from Shavercombe Farmstead, **Mon 975**, which also lies at the foot of Shavercombe Brook. However, to avoid confusion this title is retained. Haynes also identifies this farmstead with Hentor Cot, the residence of a labourer on Hentor farm. However, this may not have been the earliest occupation. The field, **Mon 992**, associated with the longhouse, has been partly destroyed by tin working, which suggests origins earlier than the 16th or 17th centuries. A tinwork called Shabcomb / Shabbercombe is recorded in 1527 and 1625. (WDRO 72/990/15; 72/1034)

The original extent of the field is unknown. The absence of any other fields or traces of cultivation suggests a pastoral economy. The longhouse, Mon 991a, is located in the W corner of the field, and is accompanied by a small yard, Mon 991b. The two-compartment longhouse is similar in size and plan to Shavercombe, Mon 975, and Spanish Lake, Mon 543, and is depicted in fig 3:8 and described in detail in App. F.

g) Ringmoor Down

Three farmsteads are situated on the south-facing slope of Ringmoor Down. Following Linehan's terminology (1966, Table II), the name "Ringmoor Down" is restricted to the northernmost, Mon 344, while "Legis Tor" refers to the farmstead, Mon 325, N of the tor, and "Legis Lake" is applied to the westernmost farmstead, Mon 315.

It is not possible to arrange these farmsteads in any chronological sequence on the basis of archaeological evidence. Legis Tor farmstead, Mon 325, is the least well-preserved, but its proximity to the Legis Tor boundary wall. Mon 197a, strongly suggests that it was heavily robbed by the wall-builders. Therefore, it would be a mistake to assume greater antiquity on the grounds of poor preservation. It is indeed possible that the farmsteads are contemporary; two may have been occupied by members of the same family branching out from the other parent settlement.

It may be assumed that the farmsteads are associated with the fields immediately adjacent to them. However, the whole of the S slope of Ringmoor Down has been carved up into large parcels of land by boundaries. It is difficult to attribute these to any specific farmstead and, indeed, it will be seen that some of this sub-division may have been intended for livestock from farms outside Ringmoor Down.

Considerable evidence survives for arable and pastoral farming and there is some indication that cultivation post-dates pastoralism. Thus, originally, the vestigial boundary, Mon 337, was a continuation of the long boundary, Mon 335, which defined a large area presumably for grazing. (Sheet 14) However, now this boundary is visible only from the air and was evidently removed to accomodate the large area of cultivation, **Mon** 338. Some of the furrows can be clearly seen cutting across the boundary. Cultivation may have been the sole activity at this time; it seems unlikely that an area of cultivation would be left unbounded if livestock was also grazing in the vicinity. Thus, apart from pre-existing boundaries, **Mons** 331 and 326 at the S end, the area of cultivation, **Mon** 338, is unenclosed on the W and E sides. The marker stones, **Mons** 339, 341 and possibly 336, may have been the only indications of the boundary.

However, it is most likely that this was a relatively short-lived phase of outfield cultivation; grazing could have resumed soon afterwards. At other times, pastoral farming could easily have co-existed with cultivation in the enclosed fields, **Mons** 345 a-g, 342 a-e and probably 346, which seems to have been enclosed at one time.

Co-operation is also implied between farmers and tinworkers. Tin streaming seems to post-date farming on Ringmoor Down; the course of the streamwork gullies, which follow both tributaries of Legis Lake, is clearly dictated by a pre-existing pattern of fields and boundaries. Thus, the W gully, **Mon** 347, extends along field boundaries, **Mons** 285, 345a and 345b, while the E gully, **Mon** 343, bypasses an outbuilding, **Mon** 344i, and continues around a field, **Mon** 342. However, care has obviously been taken not to destroy the fields or the outbuilding, which suggests contemporaneity between tinworking and, at least, the farmstead, **Mon** 344.

The numerous prospecting pits in the W of the area show less respect for boundaries; pits have cut into boundaries, **Mons** 279a, 279b and 278b. An openwork cuts across the E wall of the field, **Mon** 270.

i) <u>Legis Lake Farmstead</u>

Legis Lake farmstead, **Mon** 315, is situated on a very gentle slope on the W bank of Legis Lake, just above the ford. It consists of a two-compartment longhouse, **Mon** 315e, two single-compartment outbuildings, **Mons** 315a and f, and four yards, **Mons** 315b, c, d and g, all of which are described in detail in App. F.

This farmstead may be associated with the large trapezoidal field immediately to the W. This is enclosed by boundaries, **Mons** 275a, b, c and 276a, and is sub-divided by a vestigial wall, **Mon** 275e, which is only clearly visible from the air. These boundaries may post-date the farmstead; thus, the outbuilding, **Mon** 315f, seems to form part of the boundary, but is not directly in line with it. This suggests that the boundary, **Mon** 275c, was built up to a pre-existing structure, **Mon** 315f. However, it is still likely that the farmstead was in use when the field was enclosed, as it has been carefully included within the field. No traces of cultivation can be detected, while the considerable amount of stone within the field suggests that it was not used for cultivation but probably as a stock enclosure.

ii) Legis Tor Farmstead

Legis Tor farmstead, **Mon** 325, is situated on almost level ground on the E bank of Legis Lake, to the N of Legis Tor. Remains of four rectangular structures, **Mons** 325c, d, e and g, can be identified as well as two level platforms or plots, **Mons** 325f and h, and isolated wall fragments. All these are depicted in fig 3:11 and described in detail in App. F.

Interpretation of the remains is extremely difficult because of later damage. The wall, **Mon** 197a, marking the Legis Tor Warren boundary, clearly kinks southwards to avoid the farmstead, but still seems to have destroyed the S ends of structures, **Mons** 325c, d and e, while building material for the wall was presumably quarried from the farmstead. On the N side, the farmstead suffered further damage from a track.

The structures, **Mons** 325c and d, seem to be single-compartment buildings, enclosed by very widespread earthen banks, but their present form is hardly the original one. Probing revealed minimal stone content within these banks and it is therefore possible that the banks are remains of a turf or sod wall. The presence of a few stones facing the inner and outer edges of the SW wall suggests that the whole structure may have been similarly stone-faced. Removal of this stone facing by the wall builders might accelerate weathering and cause the banks to slump. This is highly conjectural as the original proportion of stone content cannot be assessed. However, the survival of these broad earthen banks suggests that turf or sods formed a major component of construction.

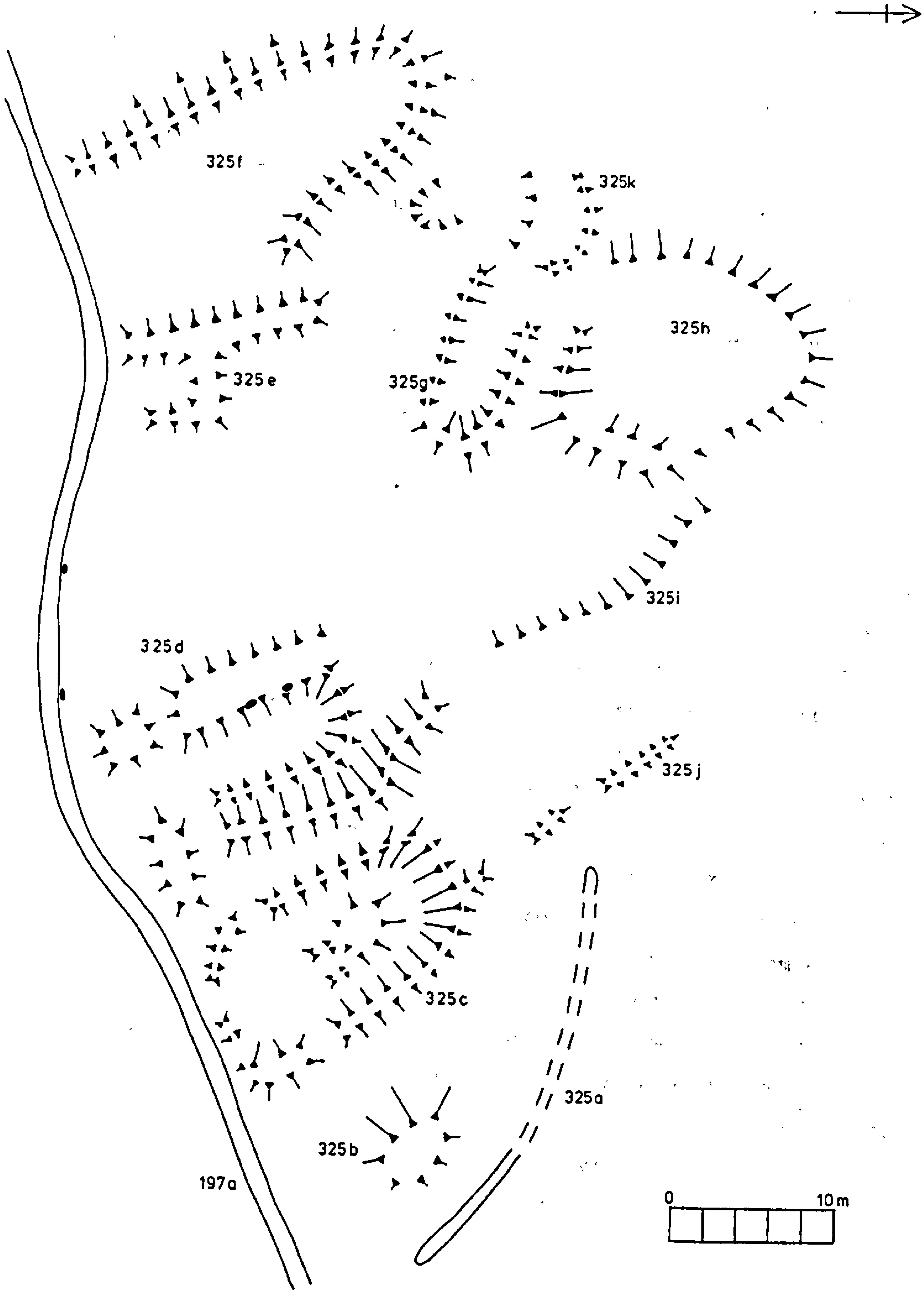


Fig. 3:11 Legis Tor farmstead

It is likely that the fields immediately to the N of Legis Tor farmstead are associated with it. A large irregularly-shaped area is enclosed by earthen banks with ditches; on the E by **Mon 326**, and on the W by **Mons 331** and **328**, which were probably a single boundary but were later interrupted by a tin streamwork, **Mon 330**. Originally, the area was bounded on the N by **Mon 337**, which was removed during an episode of cultivation, and was sub-divided by **Mon 332**.

iii) <u>Ringmoor Down Farmstead</u>

Ringmoor Down farmstead, **Mon 344**, is the northernmost of the three farmsteads on Ringmoor Down. It is situated on a gentle slope between the two tributaries and tin streaming channels of Legis Lake. The farmstead consists of a two-compartment longhouse, **Mon 344c**, two single-compartment outbuildings, **Mons 344e** and **i**, and a small outhouse, **Mon 344g**, associated with four platforms or plots, **Mons 344a, b, f** and **h**, all of which are depicted in fig 3:12 and described in detail in App. F.

The farmstead occupies one corner of, and is almost certainly associated with, the field system to the W, enclosed by boundaries, **Mons 345a**, **b** and **f**, and subdivided into four fields by **Mons 345c**, **d** and **e**. The large field to the E of the farmstead is also probably part of this field system, though the boundary ditches, **Mons 342a - d**, may not contemporary with the cultivation, **Mon 342e**. The ditches are a continuation of the eluvial streamwork, **Mon 343**, along the E tributary of Legis Lake. The absence of any banks suggests that the ditches were not excavated in the construction of a simple ditch and bank field boundary, unless the material from the ditch was spread over the interior of the field. Therefore, it seems likely that the ditches derive from eluvial stream-working, though there is no evidence of a water supply for washing debris downstream. Restriction of the tin working to the edge of the field provides clear evidence of co-operation between tinners and farmers. The ditches may have engulfed earlier boundaries, such as the low banks and narrow ditches elsewhere on Ringmoor Down, or it is possible that the area of cultivation was originally unenclosed like the rig and furrow further S, **Mon 338**.

It seems likely that all the traces of cultivation belong to the same episode of occupation. Therefore, the field, **Mon 346**, the area of

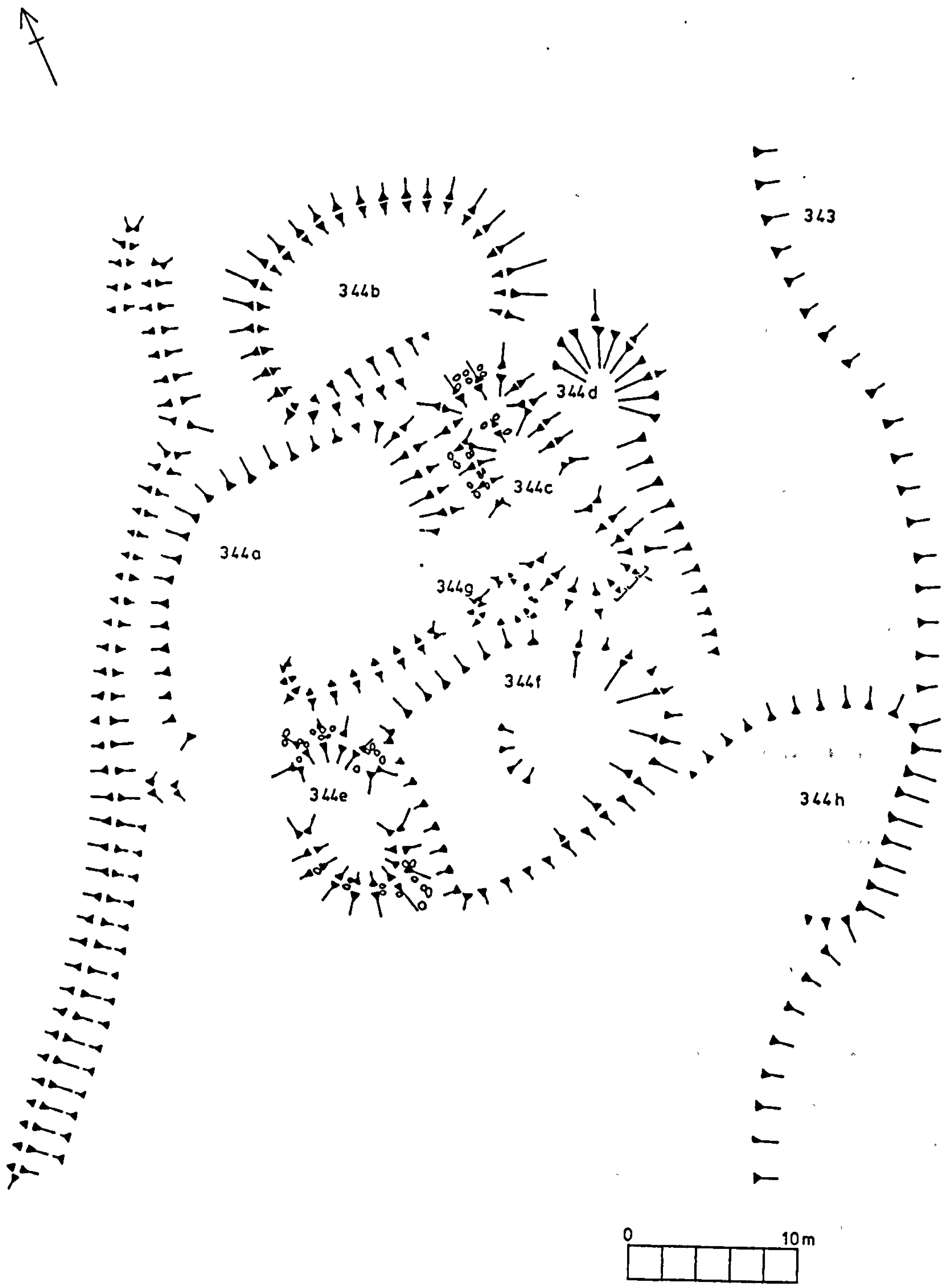


Fig. 3:12 Ringmoor Down farmstead

rig and furrow, **Mon 338**, and the field defined by boundaries, **Mon 617a** - c, may also be associated with Ringmoor Down farmstead.

iv) Pasture on Ringmoor Down

It is difficult to associate other boundaries with one specific farmstead; rather these may relate to the land management of Ringmoor Down as a whole. The large area to the W of Legis Lake, defined by boundaries, **Mons 276a** - e, stretches between Legis Lake and Ringmoor Down farmsteads. The common boundary, **Mon 276a**, which it shares with the Legis Lake field, **Mons 275a** - e, indicates close association with Legis Lake farmstead, but the route of the northern boundaries, **Mons 276d** and e, suggests co-operation with Ringmoor Down farmstead.

Mons 276d is constructed parallel to and 8m to the SE of an element of the Eylesbarrow reave, **Mon 271c**. Elsewhere on Ringmoor Down, this reave has been incorporated in Medieval boundaries and, therefore, the construction of another boundary, only 8m away, suggests the deliberate provision of a corridor, presumably a drove-way for livestock. At its NE end, the drove-way, **Mon 277**, opens into a small enclosed area at the W end of the Ringmoor Down farm field system. A curving bank, **Mon 285**, enlarges the area previously enclosed by the reave. The tinners' gully, **Mon 347**, has destroyed the original relationship between this area and the field system but possibly this area opened directly onto the interfluve between the two tributaries of Legis Lake. The latter may then have been an area of pasture belonging to Ringmoor Down Farm.

The drove-way, **Mon 277**, thus, provided access between Ringmoor Down farmstead and its adjacent pasture, and a large area of grazing to the SW. At some stage access was provided to the SW spur of Ringmoor Down. (Sheets 13 and 14) This area was bounded on the S by the corn-ditch, which separates Ringmoor Down from the enclosed fields of Brisworthy, and by an earthen bank and ditch, **Mon 265**. To the N, the area was enclosed by a refurbished element, **Mon 271a**, of the Eylesbarrow reave and by the fields and large enclosure associated with Legis Lake farm. A gap between the boundaries, **Mon 265**, and **Mon 275b** - d, at the E end of the area, presumably provided access to a water supply in Legis Lake. This area may also have been available for livestock from farms outside

Ringmoor Down and access may have been by the drove-way through the corn-ditch, which defines the S side of Ringmoor Down. This opens into the area now covered by Brisworthy Plantation.

Access also seems to have been provided to a small area to the NW. (Sheets 13 and 21) A boundary, **Mons 278a** and **b**, running from the SW end of the reave element, **Mon 271c**, across the cairn, **Mon 281**, to the boundary defining the W edge of Ringmoor Down, separates the S slopes of Ringmoor Down from the N slopes. An element of the Eylesbarrow reave, **Mon 271b**, has been removed, thereby providing access to the SW side of this boundary. Another boundary, **Mons 279a** and **b**, running from the NE end of the reave, **Mon 271a**, and over the cairn, **Mon 280**, defines a corridor into this area.

Further E, the northern slopes of Ringmoor Down are separated from these southern enclosures by the reave element, **Mon 271c**, the curving bank, **Mon 285**, and the N boundary, **Mon 345a**, of the field system. The land to the E of Legis Lake was also divided into large areas for pasture. It cannot be ascertained if the tinners' gullies, **Mons 342c** and **b** have engulfed earlier boundaries. (Sheet 14) However, at least the S ditch, **Mon 342a**, of this field is a continuation of a long earthen bank with a ditch, **Mon 340**, and therefore may follow an original boundary line. The E end of Ringmoor Down has been disturbed by later boundaries; the wall, **Mon 642a**, probably dates to the amalgamation of Legis Tor Warren with Ditsworthy Warren. (See below p.263) (Sheet 15) Therefore, the boundary, **Mon 340**, originally continued into **Mon 626b**, which almost reaches the R. Plym. Morphology and the overall plan suggests that **Mon 340** is contemporary with **Mon 617a**. These two boundaries have been constructed in such a way to leave access between open pasture on N Ringmoor Down and water supply at the R. Plym. The corn-ditch, **Mon 624b/629**, may be later than the Ringmoor Down boundaries; it certainly seems to post-date the field, **Mon 617**. However, the absence of **Mon 629** would not necessarily alter this interpretation.

The long boundary, **Mon 340/626b**, is abutted by another long boundary, **Mon 337/335/625b/625c**, thereby defining another area of pasture, or stock enclosure. It may have been originally enclosed on the W side by the E tributary of Legis Lake, or by a boundary, later removed by tin working. Access into this large area was by a wide gap on the N side. It was subdivided near the E end by a boundary, **Mon** 616, which encloses a small field, with separate access at its NE corner. The fields which seem to be associated with Legis Tor farmstead abut the S boundary.

Therefore, while the N slope of Ringmoor Down remained unenclosed open pasture, the S slope is divided into large areas of pasture, or stock enclosures, but it is difficult to establish a chronological sequence. According to the overall plan, the boundaries to the W of Legis Lake seem closely related and therefore planned contemporaneously in association with Ringmoor Down and Legis Lake farmsteads.

A possible chronological sequence lies in the slight, and far from certain, evidence for an earlier date for Legis Tor farmstead. It was demonstrated above that cultivation, **Mon** 338, post-dated a pasture boundary, **Mon** 337. It is possible therefore that the pasture defined by **Mon** 340/626b and **Mon** 337/335/625b/625c and the field, **Mon** 617, belong to an earlier phase associated with Legis Tor farmstead. Ringmoor Down farmstead later used the W end of the boundary, **Mon** 340, in its field system, and later still expanded cultivation southwards and into the field, **Mon** 617.

It may also be pointed out that the earthen banks, which defined areas of pasture, as visible today would hardly have restrained sheep or cattle unless they were topped by a fence or hedge. If not, they may simply have defined territories or parcels of grazing pertaining to a particular farm or farms. Fox notes that private wastes were sometimes left unenclosed or defined by low banks "which allowed the livestock from neighbouring farms to intercommon, but which clearly demarcated the acreage of rough land belonging to each holding." (1971, 142) However, there is no suggestion in the documentary record for Ringmoor Down that any parts of it were allocated to particular farms.

h) Gutter Tor

Gutter Tor farmstead, **Mon 677**, is situated high up on an E-facing slope, SE of Gutter Tor. A prehistoric enclosure, **Mon 670**, attests earlier occupation at Gutter Tor, though the Medieval farmstead was built 160m away. However, the prehistoric enclosure seems to have been used as a landmark in laying out the field system, while dilapidation of the enclosure and its hut-circles suggests that it was heavily robbed for later building. A series of fields, A to F, runs from the farmstead, southwards to the R. Plym. (Fig. 3:13) Morphology, horizontal stratigraphy and the overall plan provide evidence for at least two phases of enclosure, and it is possible that not all of these fields were associated with the Gutter Tor farmstead.

According to the horizontal stratigraphy, the earliest element of this system is the northernmost boundary, **Mon 676b**. At its western end, this boundary is truncated by the corn-ditch, **Mon 624b**, which defines the W side of the series of fields. At its E end, the boundary is closely associated with the farmstead, **Mon 677**; it joins a dilapidated structure, **Mon 677e**, which was later incorporated in a yard, **Mon 677f**. The E side of Field A is also closely associated with the farmstead; the N end of the boundary, **Mon 630b**, meets the yard, **Mon 677f**, and seems to kink westwards to avoid the structure, **Mon 677d**.

These two boundaries are similar in construction and may correspond to clearance walls. The composition of **Mon 676b** of very large boulders is echoed in the crude boulder facing on the E side of the boundary, **Mon 630b**. The earthen component on the W side of the latter may even be a result of the accumulation of soil creep against a boulder wall rather than of the construction of a bank. The boundaries are morphologically distinct from the earthen banks with ditches, which form the other elements of the field system. This may largely reflect their location in an area of clitter surrounding Gutter Tor. However, the morphology supports a close association with the farmstead; huge groundfast clitter boulders were incorporated in the structures, **Mons 677a and b**.

It is possible that the two boundaries were part of an enclosure constructed contemporaneously with the farmstead, but refurbished when the corn-ditch and related boundaries were built. **Mons 676b and 630b**

Fig. 3:13

Gutter Tor field system:
Gutter Tor farmstead and
Ditsworthy Phase II

may be the original N and E boundaries of the enclosure. There is also evidence for a contemporary western boundary, later incorporated in the corn ditch, **Mon** 624b. E of the junction with the corn ditch, the boulder wall, **Mon** 676b, continues the SW-NE alignment for 20m, before turning sharply eastwards to enclose the N side of the field. This SW-NE element may be the surviving fragment of the original western boundary. Furthermore, a sharp kink at this junction in the otherwise mostly straight corn-ditch suggests a change of course in order to utilize a pre-existing boundary. Another kink further N, may have been necessary to avoid outlying boulders of the tor.

The location of the original S boundary of the early field is unknown. The ditch, **Mon** 673, which presently sub-divides Field A, seems to be a late addition, possibly provided to drain surface water from the pillow mound, **Mon** 672, on its S side. From the plan, the present S boundary of Field A seems to be the most likely location. An earlier boundary may underlie the earthen bank and ditch, **Mon** 637b, which is integral with the corn-ditch and with the earthen bank, **Mon** 630a. The S part of the E boundary of Field A, which corresponds to the northern element of **Mon** 630a, N of its junction with **Mon** 637b, is broader and more substantial than **Mon** 630b, and, therefore, was probably refurbished either in the subsequent phase of enclosure or by warreners. The latter incorporated it into two pillow mounds and inserted a vermin trap.

Therefore, the farmstead and at least three sides of an enclosure and probably the whole of Field A, can be identified as the earliest visible evidence of the Medieval occupation of the site. The occupants may have concentrated on pastoral farming; certainly there is no undisputed evidence of arable farming. No traces of cultivation can be detected in Field A on aerial photographs, though this negative evidence is hardly conclusive. The build-up of soil against the E boundary may be a result of natural soil creep rather than lynchetting. Furthermore, Haynes' discovery of a millstone, W of the structure, **Mon** 677b, need not necessarily imply that arable farming was undertaken. (Haynes Map DIT) Millstones may also have had an important role in pastoral farming; fodder crops, such as oats or barley, can be bruised in a mill to release nutrients and these crops could have been brought in from an arable farm. Indeed, under the Manorial system, in which tenants were often obliged to take their corn to the lord's mill for processing, milling might not necessarily be expected on an arable farm.

At some stage, Field A was incorporated in a large field system, which was enclosed on the W and S sides by the integral corn-ditches, Mons 624b and 629, and on the E side by another boundary of corn-ditch construction, Mon 630a. Mon 624b also continued northwards, thereby enclosing the entire E slope of Ringmoor Down from the R. Plym at its confluence with Meavy Pool almost to the ford across Sheepstor Brook. These fields were later incorporated in Ditsworthy Warren. Thus pillow mounds and vermin traps were constructed within the fields and against field boundaries. Furthermore, the total acreage of 223 acres and 11 perches, recorded in the Tithe Apportionment of 1842 for Ditsworthy warren corresponds closely to the area, covering 234.74 acres (95ha), bounded by the corn-ditches, Mons 629 and 624b, Sheepstor Brook, boundaries, Mons 733 and 730, and the R. Plym.

Therefore, Ditsworthy Warren must include the Gutter Tor fields. However, it is suggested that the Ditsworthy tenants used these fields for arable farming before warrening was introduced, and, indeed, may even have been responsible for the initial enclosure of them. It is clear that the corn-ditch enclosing the W and S sides of the field system was not initially intended as a warren boundary. The external wall face was designed to exclude animals from the fields; rather than contain rabbits within them.

Integral junctions between the corn-ditch, Mon 624b, and internal field boundaries and between the latter and the E boundary, Mon 630a, suggests that the field system was designed as a whole. Some junctions, for example, between Mon 632b and Mon 630a, and between Mon 631b and Mon 624b cannot be interpreted because of later damage. However, Mons 637b, 636b and 632b are integral with the corn-ditch, Mon 624b, while Mons 637b and 631b are integral with the eastern corn-ditch, Mon 630a. Evidence of a sequence of construction, for example where Mon 636b abuts Mon 630a, and where Mon 630a abuts Mon 629, may simply have occurred in the process of building.

The use and initial enclosure of these fields by Ditsworthy is suggested particularly by the relationship of the gully, Mon 634, with the field system. This gully curving between Fields C and D to the gateway through the corn-ditch, Mon 624b, may be interpreted as a holloway providing access for livestock to the open pasture on Ringmoor Down. Breton refers to a track, known as "Ditsworthy Carriage Drive", running along the S side of the crest of Ringmoor Down and connecting Ditsworthy to Ringmoor Cottage and Meavy village. (1911, 50) This might correspond to a track, which used the same entrances through the corn-ditches but followed a straighter course to the N. There is no sign of any embankment on either side of the holloway, but the depth of the gully may have been sufficient to deter livestock from straying into the field. The E end of the gully splays out in a funnel at the ford across Meavy Pool, leading to the track to Ditsworthy Warren House, and, therefore, is clearly associated with Ditsworthy Farm. The careful provision for access through the fields indicates combined arable and pastoral activities at Ditsworthy.

However, it is also most likely that the E boundary of the field system, and by implication the whole field system, was designed to accomodate the holloway. This seems to be the most convincing explanation for the dog-leg in the E boundary of Field C.(see fig 3:13) The entrance for the holloway through the E boundary is at a right-angled bend. On the S side of the gap, the boundary continues southwards at an angle of approximately 45° to the gully, but on the N side, the boundary turns westwards for a short distance, also at about 45° to the gully, before continuing northwards. These barriers on either side of the gully would act as a funnel, so that any livestock moving eastwards would be effectively channelled towards the gateway.

A further connection between the Gutter Tor field system and Ditsworthy Farm may be the boundary, Mon 680, which runs from Gutter Tor farmstead to Gutter Mire. It is likely that this boundary post-dates the farmstead; it seems to be superimposed on a yard, and cuts off the longhouse, Mon 677a, and two outbuildings, Mons 677b and c, from another outbuilding, Mon 677d, and associated yards. Moreover, its "corn-ditch" construction indicates a morphological association with other elements of the later field system. The connection with Ditsworthy is suggested from the plan; an eastward extension of this boundary would continue into the N boundary of the Ditsworthy enclosures, Mon 733. This is a remote possibility, but a connecting wall across Gutter Mire could have been destroyed by tinworking. It would have provided a logical northern boundary for the combined Gutter Tor and Ditsworthy field systems.

Traces of cultivation can be detected from the air in the five fields, B to F, of the second phase of enclosure. They are particularly well-preserved in Field E, where ten furrows can be detected, about 5.50m apart.

The relationship to the Ditsworthy or Gutter Tor field systems, of the large field, Mon 617, W of the corn-ditch, Mon 624b, is not clear. This field seems to pre-date fields, B to F; it is truncated by the corn-ditch, Mon 624b. Furthermore, it may have been abandoned before the field system was constructed. The holloway, Mon 634 does not continue westwards through it, though later damage by vehicle tracks, created during the Second World War, precludes identification of damage to cultivation traces by animal gullying. There is no indication of the original eastern boundary of this field. It does not seem to have continued E of the corn-ditch; the N and S boundaries, Mons 617c and 617a are not in exact alignment with boundaries on the opposite side of the corn-ditch. Possibly the E boundary was incorporated in the corn-ditch, though there is no positive evidence for this.

It is possible that the field, Mon 617, was contemporary with Gutter Tor farmstead, though the layout of this field in relation to Field A seems illogical. Alternatively, it may have been associated with activities further W on Ringmoor Down. The boundaries are morphologically similar to the earthen banks with ditches on Ringmoor Down, while the S boundary, Mon 617a, seems to have been carefully constructed to leave a narrow opening between it and another boundary, Mon 340. Furthermore, the great size of this field, of 15.66 acres (6.34ha) is much larger than than the Ditsworthy fields devoted to arable, which average three to four acres and the Gutter Tor fields, which average two and a half to six acres, and is more akin to the large arable fields further W.

Gutter Tor Farmstead consists of a three-compartment longhouse, **Mon 677a**, three single-compartment outbuildings, **Mons 677b - d**, and a dilapidated structure, **Mon 677e**, which was later incorporated in a yard, **Mon 677f**(See fig 3:14). The structures are associated with three yards, **Mons 677f - h** and all are described in detail in App. F.

The massive boulder construction of the longhouse and outbuildings contrasts with the regular coursed masonry of most of the other Medieval farmsteads in UPV. Only two structures at Legis Lake, **Mons 315a** and **f**, contain a similar type of construction. This mainly reflects the farmstead's location within the Gutter Tor clitter and the structures have been built around groundfast boulders. Apart from the massive boulders, the composition of the overgrown denuded walls is difficult to identify. Small stone rubble can be detected in most of the structures, and it is possible that a mixture of stones and turf sods was used to build up the walls.

i) Ditsworthy

The fields belonging to Ditsworthy Farm and the later warren stretch across the southern slope of Eastern Tor, within an area defined by Meavy Pool in the W and by the R. Plym in the S. Again, earlier occupation in the vicinity may have influenced the choice of location, though, apart from the cairn, **Mon 873**, which may have ancient origins, the extant prehistoric occupation is restricted to an area of heavy clitter, NE of the Medieval fields. Although some clitter was probably cleared for the Medieval settlement, the curving, wedge-shaped pattern of the field system may have been designed to fit between the area of densest clitter and the tinworks on the R. Plym. The westernmost fields were later used for warrening; pillow mounds have been built within them. The easternmost fields, to the S of the present house, were maintained until the warren was abandoned and are still visible as a green oasis within rough moorland.

The overall plan of the field system suggests that it was laid out in a single phase, followed by only minor additions and sub-divisions. (Fig3:15) Thus the fields fit neatly together in a compact group within a relatively regular outline.

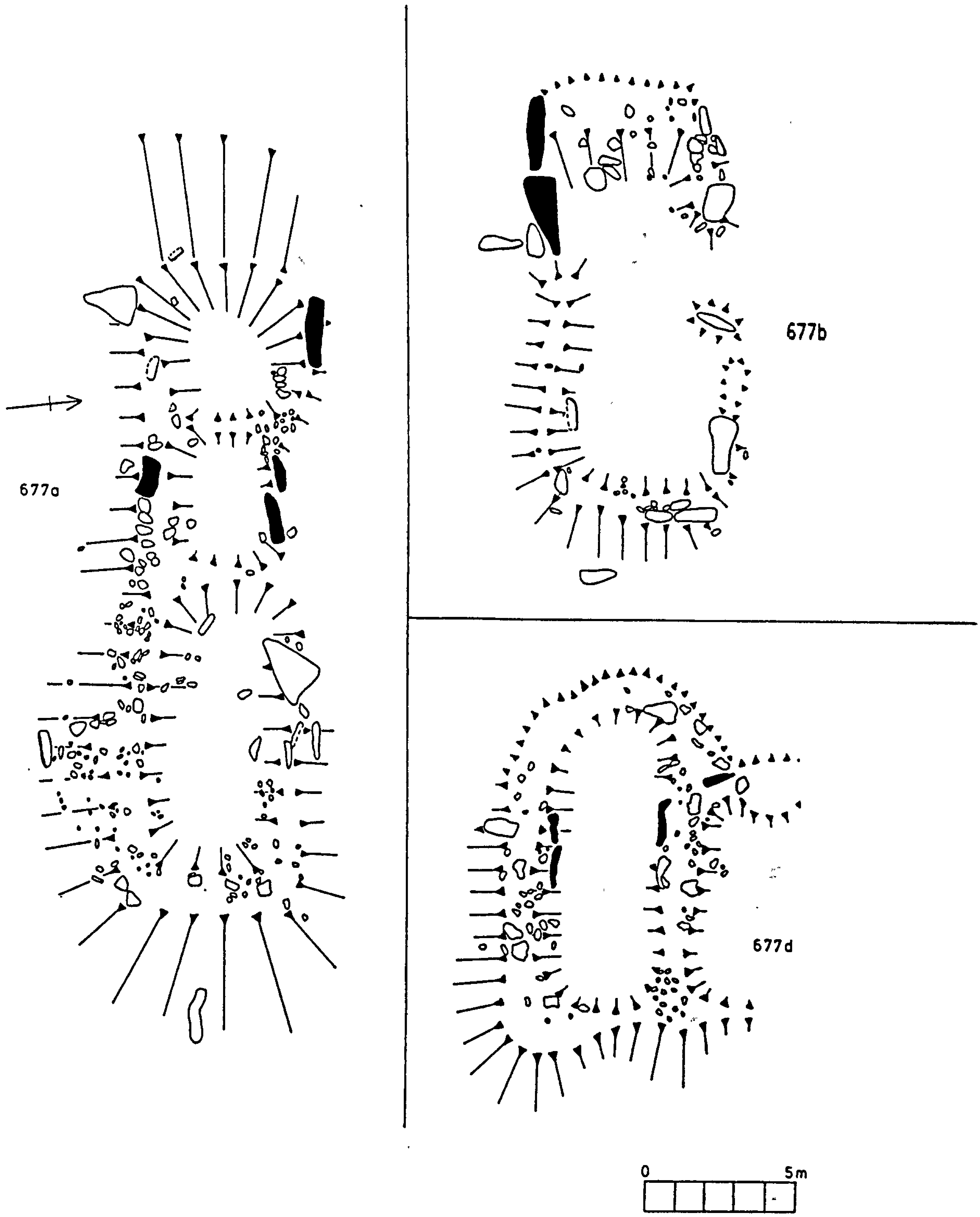


Fig 3:14 Houses at Gutter Tor farmstead.

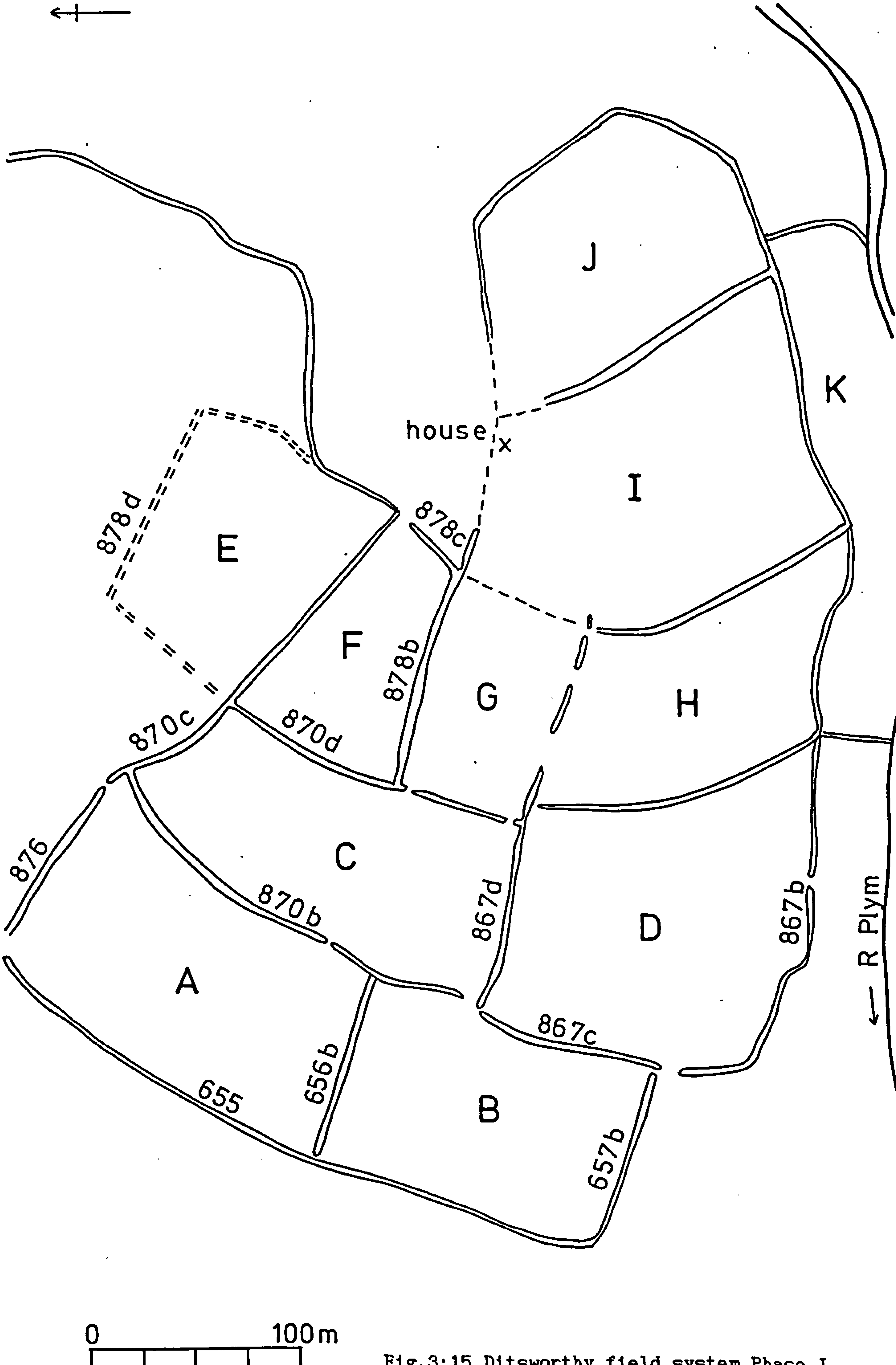


Fig.3:15 Ditsworthy field system Phase I

By eliminating obviously late additions, it is possible to reconstruct the even smoother outline of the original field system. For example, the high dry-stone walls immediately surrounding the present house, particularly in the enclosure, **Mon** 880j, are morphologically late and thus the boundary, **Mon** 878b, may originally have continued on the same course to join the N side of the field, **Mon** 880h. It is clear that some of the fields, which continued in use into the 20th century, such as **Mons** 880d, 880h and 880g, are sub-divisions of earlier fields. Therefore, it may be suggested that the enclosed land was originally divided into six sub-rectangular fields (A, B, C, D, I and J) of approximately similar area, between three and four acres, and four smaller fields (E, F, G and H) of about half that size, together with a further irregularly-shaped field, K, on the bank of the R. Plym.

Morphology and horizontal stratigraphy suggest that some chronological distinction can be discerned within the field system. Morphologically, the boundaries, **Mons** 655 and 657b, consist of a broad earthen bank faced externally with dry-stone masonry, typical of the corn-ditch. The fields, A and B, enclosed by this corn-ditch, are also bounded by a broad gully, with a vestigial bank on its S side, **Mon** 876, and a boulder wall, **Mon** 656b. The W and N boundaries of Field C, **Mons** 870b and 870c, consist of dry-stone walls, while the E boundary, **Mon** 870d, consists of a broad earthen bank containing large stones at the N end and a wall of denticulate stones, possibly akin to Fleming and Ralph's "block-wall" at the S end. (1982, 105) The boundaries of Field F, **Mons** 878b and 878c, are earthen banks, while the perimeter of Field D, **Mons** 867b, c and d, is composed of earth and stone.

Horizontal stratigraphy suggests that boundaries, which are morphologically the same, belong to the same chronological horizon. Thus the integral junction between the corn-ditches, **Mons** 655 and 657b, indicates that these were constructed in the same phase. A similar relationship is demonstrated between the earth and stone banks, **Mons** 867b, c and probably d, between the dry-stone walls, **Mons** 870b and c, and between the earthen banks, **Mons** 878b and c. However, it is difficult to establish the relationship between each morphological group. Thus the junction between an earth and stone bank, **Mon** 867c, and a dry-stone wall, **Mon** 870b,is damaged by a track, while, by the very nature of its construction, the block-wall, which forms the S end of boundary, Mon 870d, does not betray its relationship with other types of boundary. The only clear sequence is the truncation of the corn-ditch, Mon 657b, and the boulder wall, Mon 656b, by the earth and stone bank, Mon 867c, and the dry-stone wall, Mon 870b, respectively.

However, it is more likely that any sequence, demonstrated by morphology or horizontal stratigraphy, is a result of refurbishment rather than the initial construction of individual boundaries. The overall plan suggests that a piecemeal enclosure of fields, extending gradually outwards is most unlikely. Thus the truncation of the corn-ditch by Mon 867c was probably in the course of refurbishment of an existing wall, rather than in an extension. Refurbishment can also explain anomalies. Thus the wall, Mon 870b, truncates the S boundary of Field A, Mon 656b, but is integral with the E end of the N boundary. A continuing process of refurbishment is well-demonstrated in Field H, where a dry-stone wall, currently defining the N side, is clearly a replacement for the eastern part of the earth and stone bank, Mon 867d, which is still visible further N.

Therefore, while the fields were probably enclosed in a single phase, the extant boundaries belong to successive phases of refurbishment. The corn-ditches, Mons 655 and 657b, were the original western boundary, possibly associated with the boulder wall, Mon 656b. The block-wall, Mon 870d, may also be a survival of the earliest phase. However, other types of boundary are probably refurbishments and the earthen banks and the earth and stone banks may not differ widely chronologically.

It is possible that some boundaries do represent later phases of enclosure. Mon 878d can only be detected clearly from the air and its relationships with other walls are difficult to establish. However, the overall plan suggests that this represents a later extension of the field system, particularly as it lies within the area of clitter, otherwise avoided. It is also possible that Field K, Mon 880e, is a relatively late addition; its W and E boundaries have been built over tinwork remains, which are elsewhere respected by the S perimeter of the field system. Partition of the eastern fields is also suggested by the plan. Thus Mon 880d is a sub-division of a larger field, I and Mons 880h and 880g once formed a single field, which itself may have been a sub-division of a larger field, J. The partition between **Mons 880f** and **880h/g** is a massively-built wall-bank, which, according to Fleming and Ralph is relatively late in the sequence of boundary construction. (1982, 104-5) The partition between **Mons 880h and g** is a simple coursed wall, which post-dates the revision of the OS 6 inch Map in 1904. (OS 6" Map 1906)

However, archaeological and documentary evidence suggests that **Mon 880a** is not simply a late sub-division. When the E part of **Mon 867d**, which formed the N boundary of Field H, was replaced, a corn-ditch was built to enclose only **Mon 880b**, as marked on early editions of OS 6 inch Maps. (OS 1st and 2nd Eds. 6" Maps 1887, 1906) Only later, after the 6 inch map was revised in 1904, was **Mon 880a** added, following the original boundary of Field H. Thus the corn-ditch around **Mon 880a**, is built over the track, which originally followed the NW side of **Mon 880b**, and consists of a different type of masonry, comprising regular-sized blocks, in contrast to the large boulder base topped with smaller stones of **Mon 880b**.

The mid-19th century field system and land use are recorded in the Tithe Map and Apportionment. (Fig.3.16) (WDRO MFC 717; DSMR Sheepstor Tithe App.) The pattern of fields in use in 1842-3 survived almost intact into the 20th century but a few minor alterations have been made; **Mon 880a** was added to **Mon 880b**, a yard, **Mon 8801**, was added next to the house and a small enclosure, **Mon 880i**, which, according to Haynes, was the peat house, was created out of a corner of **Mon 880h**. (Haynes Map DIT 44)

At some stage, a large area of 15.89ha (39.27 acres) was enclosed to the N. It is defined by a clearance-wall, **Mons 728** and **733**, running eastwards from Field E, continuing along the contour to enclose Eastern Tor, and returning westwards to Gutter Mire. Originally it may have continued to the river, thereby fully enclosing the area. This western part could have been destroyed by tin streaming; at least part of **Mon 733** seems to have been consumed by a gully.

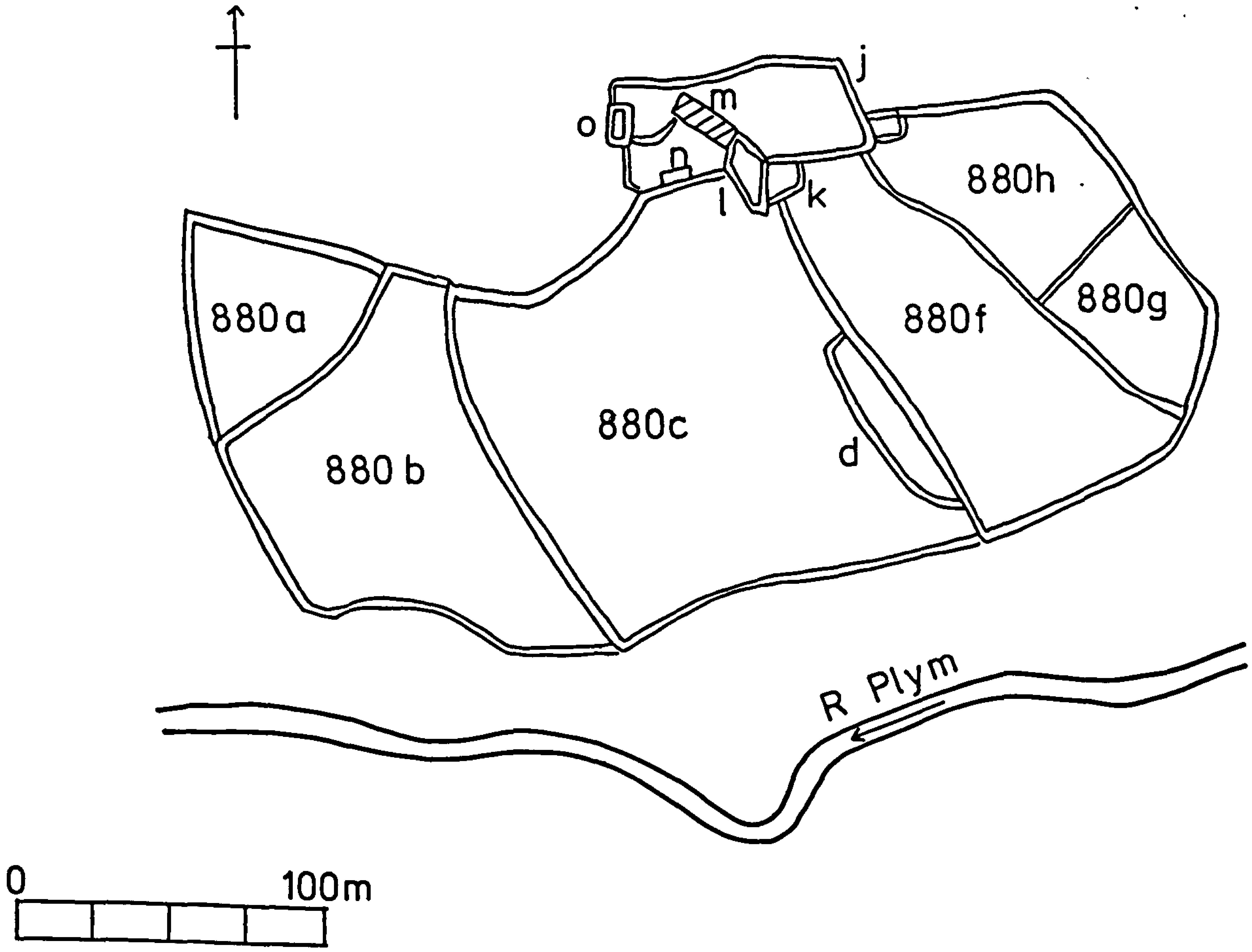


Fig. 3:16 Ditsworthy field system Phase III

Mon	Field Name	Land Use
880 b	Outer Meadow	Meadow (Hay)
880 c	Great Meadow	Meadow (Hay)
880 d	Plot	Meadow (Hay)
880 e	Long Plot or warren	Pasture
880 f	Great Field	Arable
880 g	Three Corners	Pasture
880 h	Little Field	Pasture
880 j	Kennel Count	Arable
880 k	Mowhay (haymow)	Storage

(Information from Tithe Map and Apportionment. WDRO MFC 717; DSMR Sheepstor Tithe Map and Apportionment)

The builders economically exploited pre-existing structures; the sinuous course of the wall, SE of the tor, is a result of incorporating parts of the perimeters of prehistoric enclosures, **Mons** 886a, 887a and 904a, while the bifacial and orthostatic construction at these places betray early origins. Elsewhere the boulder composition of the wall is probably a reflection of its location in the area of dense clitter. The wall is divided into two elements, **Mons** 728 and 733, by the later pot-water leat, **Mon** 727a. The N element, **Mon** 733, was later modified into a substantial earthen bank by the warreners; the W end was incorporated into a pillow mound, **Mon** 734, though the disturbed nature of the whole bank suggests that it was all used as a bury. The wall may initially have been constructed contemporaneously with the fields, to enclose an area of rough pasture. Refurbishment of **Mon** 733 presumably dates to the warrening period, and is probably contemporary with the eastward extension of the Ditsworthy holding, marked by the bank and fence, **Mon** 730.

Ordnance Survey fieldworkers suggest that the 19th century exterior of the present two-storey house masks earlier origins, possibly dating to the 16th century. (OS Card SX 56 NE 111) There are no suitable remains of earlier houses in the area; the building, **Mon** 880o, is of relatively late construction associated with warrening, while possible structures, **Mons** 877 and 883, are small and very vestigial. Therefore, the earliest dwelling at Ditsworthy may have been on the same site.

Haynes' and Hemery's identification of the structure, **Mon** 800, N of the Whittenknowles enclosure, as a windstrew, seems convincing. (Haynes Map DIT 54; Hemery 1983, 95) At first sight, this appears to be a rubble-filled, two-compartment longhouse, but lack of any entrances, clear partition walls or internal wall-faces within the depressions supports the alternative explanation. Hemery's further argument that it must be associated with Ditsworthy rather than Whittenknowles is also plausible, because of the absence of evidence of cultivation at the latter. However, this does not explain why the Ditsworthy farmers should have chosen a site so far from their fields and outside their boundary wall. A site on Eastern Tor would be sufficiently exposed for wind-assisted threshing and winnowing, though possibly it was necessary to be isolated from the livestock.

j) Whittenknowles

Whittenknowles Farmstead is situated within the large prehistoric enclosure, **Mon 747**, on the spur known as Whittenknowles Rocks. There is no evidence of an associated field system or traces of cultivation. The terraces, noted by Linehan (1966,123) are not associated with agriculture, but with the construction of two successive leats, **Mons 727b** and **742**, which supplied water to Ditsworthy. It has already been noted that the windstrew, **Mon 800**, situated to the N of the enclosure, was probably associated with Ditsworthy, which has ample evidence of arable farming.

Presumably the Whittenknowles settlement relied on pastoral farming and livestock could have sheltered within the large prehistoric enclosure, though its clitter-strewn interior covered with hut-circles seems hazardous. The two clitter-free enclosures, **Mons 797** and **799**, attached to the SW sector of the prehistoric enclosure, may have been more useful. The rectangular plan of **Mon 797** and the ditch, **Mon 797a**, along its N boundary suggests Medieval construction, though the orthostatic content of the W and S boundaries betrays earlier origins. Part of the interior, sub-divided by prehistoric boundaries, **Mons 788a** and **b**, was probably fully enclosed in the Medieval period by the addition of another boundary, **Mon 788c**. The composition of **Mon 788c** is quite distinct from the bifacial and orthostatic construction of **Mons 788a** and **b**. Clearance of the area within this sub-enclosure, using pre-existing hut-circles, **Mons 783** and **784**, as dumps, provided another paddock.

Whittenknowles Farmstead consists of a four-compartment longhouse, **Mon 786**, the longest and best-preserved in UPV.(see fig 3:17) It is associated with two single-compartment outbuildings, **Mons 785** and **787**, (fig 3:17) possibly two poorly-preserved rectangular structures, **Mons 795** and **796** and four plots **Mons 789, 790,791** and **792**, attached to the sub-enclosure, **Mon 788**. The Medieval occupants exploited the abundant supply of building material; at least two hut circles, **Mons 780** and **781**, have been extensively robbed. Another hut-circle, **Mon 778**, may have been re-used in the Medieval period. All are described in detail in App. F.

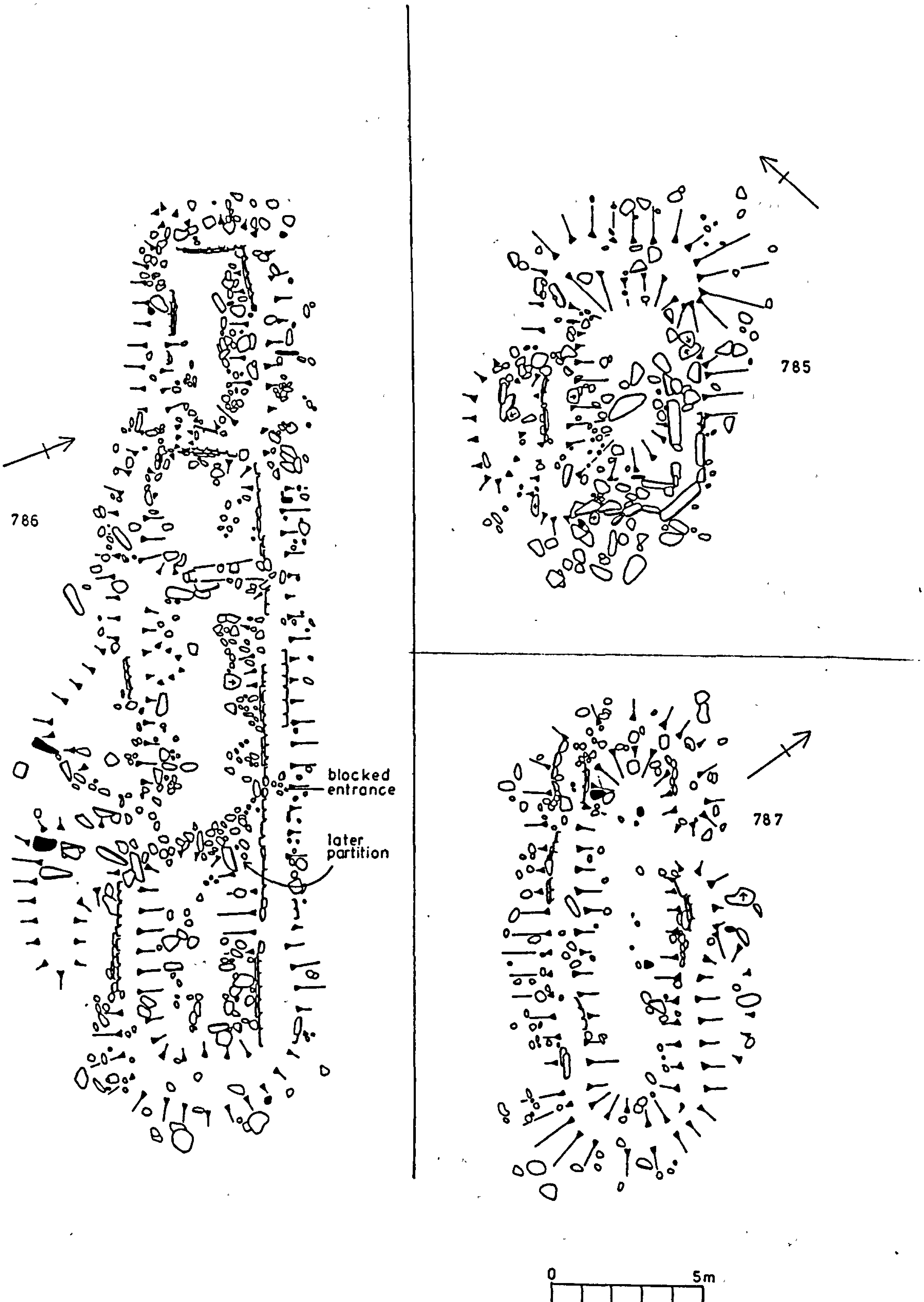


Fig 3:17 Houses at Whittenknowles farmstead

3.2.3 Discussion of the Archaeological Evidence.

a) Location

Price (1980, 83) notes the greater "space requirements" of cultivation on Medieval farms in UPV, compared to the prehistoric settlements, and thus the preference for the relatively gentler slopes, such as Hentor and Ringmoor Down. However, while the colonizers certainly chose relatively gentle slopes, it is clear that, in the earliest phase of each farm, they were attracted to particular areas on these slopes which had been occupied in prehistory. Evidence of earlier occupation might indicate an advantageous location, or, at least, endorse the settler's decision, possibly based on favourable micro-climatic or micro-pedological conditions. Furthermore, prehistoric remains provided a ready source of building material. Thus, the earliest Medieval fields at Trowlesworthy were directly superimposed on prehistoric enclosures and structures and those at Hentor, Shavercombe, Ditsworthy and Gutter Tor were laid out very close to prehistoric settlements, while adjacent parts of these gentle slopes without prehistoric remains were ignored. Medieval settlements without field systems also betray a preference for previously occupied land; Whittenknowles and Willings Walls settlements were constructed within prehistoric enclosures.

At some stage, the Medieval farmers broke free from their prehistoric forebears. A period of agricultural expansion may have demanded the construction of larger, more regular fields, particularly if there was a greater emphasis on arable farming. Thus, at Trowlesworthy, Hentor and Gutter Tor/Ditsworthy, new fields were laid out, still on the gentle slopes but away from obstructions of prehistoric structures and dense clitter.

It might then be concluded that a farm, which clearly avoided prehistoric remains from the start, may belong to a later phase of Medieval settlement in UPV. Thus the three farmsteads on Ringmoor Down are situated well to the N of the extensive prehistoric remains at Legis Tor. However, location alone cannot indicate a late date; the area to the S of the tor may simply have been too steeply-sloping for Medieval re-occupation.

b) Size and Shape of Fields.

The size and shape of fields partly reflect the nature of enclosure in UPV. Thus, the UPV field systems were all enclosed "in severalty", that is, each field system belongs to a single farm, in contrast to fields "in commonalty", which are shared by a number of farms. (Hoskins 1952b, 323) Therefore, diagnostic features of open fields will not be found in UPV, for example arable strips of about one acre within large fields, such as those identified by Fleming and Ralph on Holne Moor (1982, 111), or the enclosure of such single-acre strips, sometimes by reversed-S boundaries. (Taylor 1982, 109)

The isolated single farms of UPV represent the piecemeal expansion or "assarting" on the moorland edge. (Taylor 1982, 99-100) However, the UPV farms do not display piecemeal enclosure of individual fields. Although separate phases of enclosure have been identified at several farmsteads, in each phase, a series of fields was laid out according to a single plan.

The size of fields depends partly on function; enclosed areas of pasture are often larger than fields devoted to cultivation. For example, the absence of traces of cultivation in Field A at Gutter Tor, in contrast to the clearly visible rig and furrow in Fields B to F, further South, indicates a pastoral function. Covering 15.76 acres, this field is much larger than any of the adjoining fields, which cover a maximum of 5.24 acres. (see Table 3:2) No cultivation traces have been detected in any of the fields at Trowlesworthy, but it might be suggested that, for example, in Phase 1, some or all of the small fields, A to F, were cultivated, while the large area, Field G provided pasture. However, this is not necessarily the case: the advantage of small enclosures to intensive livestock management has already been noted(see above p.80) and, without evidence of cultivation arable use cannot be assumed. (see Table 3:1)

Variation in size is also apparent between groups of cultivated fields, and seems to reflect the chronological sequence. Thus the small irregularly-shaped fields, covering from 0.18 acres to 1.31 acres, of the earliest phase at Trowlesworthy are quite distinct from the larger rectangular fields, which cover between 2.70 and 4.85 acres of Trowlesworthy's second phase. (see Table 3:1) It may then be wondered if

Table 3:1 Size of Fields at Trowlesworthy.

Phase I. 13th. Century

	Acres	Devon Acres
Field A	0.18	0.15
Field B	0.49	0.41
Field C	0.51	0.43
Field D	1.31	1.10
Field E	0.32	0.27
Field F	1.00	0.84
Enclosure G	4.23	3.55
Area of fields A-G	8.04	6.75
Total area within Mon 140	39.03	32.79

Phase II. post 13th. Century

	Acres	Devon Acres
Field O	2.70	2.27
Field P	3.51	2.95
Field Q	4.85	4.07
Field U	4.24	3.57
Total Area enclosed	15.34	12.89

Phase III. Pre-mid 18th. Century

	Acres	Devon Acres
Field H	0.91	0.77
Field I	3.42	2.87
Field J	0.14	0.12
Field K	0.61	0.51
Field L	0.32	0.27
Field M	2.38	2.00
Field N	1.30	1.10

Phase IV. 1886 (and fields E,J,K,L,M,N,U)

	Acres	Devon Acres
Field D2	0.84	0.71
Field H/I	4.33	3.64
Field R	1.07	0.90
Field S	0.83	0.69
Field T	0.51	0.43

Phase V. 1886-1986

	Acres	Devon Acres
Field D3	0.97	0.82
Field M1(Mon 130m)	1.42	1.19
Field M2(Mon 1301)	0.90	0.81

Table 3:2 Size of fields at Ditsworthy

Phase I.

	Acres	Devon Acres
Field A	3.94	3.31
Field B	3.03	2.55
Field C	3.44	2.89
Field D	4.28	3.60
Field E	2.66	2.24
Field F	1.80	1.51
Field G	1.64	1.38
Field H	2.70	2.27
Field I	3.91	3.29
Field J	3.43	2.88
Field K	2.72	2.29
Total area of enclosures	34.86	29.32
Total area of pastures	39.27	33.03

Phase II (Gutter Tor fields)

	Acres	Devon Acres
Field A	15.76	13.24
Field B	5.24	4.40
Field C	2.65	2.27
Field D	2.65	2.27
Field E	2.89	2.43
Field F	2.89	2.43

Total area of Ditsworthy tenement, within corn-ditches, Mons 624b and 629, Sheepstor Brook, boundaries Mons 733 and 730, and River Plym = 234.74 acres (95 ha.)

Table 3:3 Size of fields at Hentor.

	Acres	Devon Acres
Field 835a	3.66	3.07
Field 841a	4.03	3.39
Field 840a	3.74	3.14
Field 842a	3.11	2.61
Field 845a	2.77	2.33
Field 847	2.00	1.68
Field 965a	1.76	1.48
Field 966a	2.22	1.87
Field 969a	1.95	1.64
Field 934a	2.51	2.11
Field 932a	2.72	2.28
Field 931a	1.56	1.31
Field 930a	1.66	1.39
Field 933a	2.11	1.77
Field 928a	1.70	1.43
Field 839	2.17	1.82
Field 838a	3.91	3.28
Field 832a	2.09	1.76

trends observed within individual farms can be translated to other farms in UPV. For example, Fields A to I at Ditsworthy, comprising the first phase, cover between 2.72 and 4.36 acres. (see Table 3:2) The similarity in size and shape with the fields of Phase II at Trowlesworthy might suggest that Ditsworthy also post-dates the earliest phase at Trowlesworthy. Furthermore, if larger regular cultivated fields post-date smaller fields, it might be concluded that the large regular cultivated fields at Ringmoor Down farm are relatively late in the sequence of occupation. Some of the cultivation at Ringmoor Down, for example, **Mon 338**, and possibly **Mon 617d**, was undertaken in areas formerly used for pasture. Therefore, the size of the area was dictated by the earlier function. However, the ability to tackle such large areas may still be restricted to a relatively late period.

While relative dating might be established by the size of the fields absolute dating is more difficult. Hoskins (1943, 87) notes that thousands of enclosures between ½ acre and 1½ acres are recorded in Devon in 13th century title deeds, and Phase I at Trowlesworthy certainly conforms closely to this pattern. Fields of 3 and 4 acres were particularly popular in Devon in the 16th and 17th centuries. (Fox 1971, 77) Thus Fox's study of manuscript sources revealed an average size of enclosure in the 16th and 17th centuries in the SW peninsula of 3.6 acres and, on Dartmoor, of 3.3 acres. (Fox 1971, 77, 86) However, fields of these sizes may have earlier origins and the 3 and 4 acre fields at Ditsworthy, at least, are surely earlier than the 16th or 17th centuries. Ditsworthy was occupied at least by 1474 and was possibly contemporary with Gutter Tor in the late 13th century; presumably its Phase I field system was enclosed by this time. (see below pp 197 and 212)

It may also be possible to identify major trends in field enclosure. Thus, the addition of 59.83 acres (24.21 ha) of northern Hentor could possibly only be attributed to a period, such as that which occurred in Devon after 1550 of "comparitively large-scale reclamation of the waste which added ten, twenty, even fifty acres at a time to an adjacent farm." (Hoskins 1943, 85)

Finally, Fleming and Ralph (1982, 113-4) were able to establish that the Devon acre was the standard unit of land mensuration in the open field at Holne Moor. (FN 1) However, comparison of the size of the UPV fields in statute acres and Devon acres is inconclusive and suggests that the exact sizing of fields "in severalty" was less important than on "open fields". (see Tables 3:1, 3:2 and 3:3)

c) Morphology

After Fleming and Ralph's (1982) detailed examination and interpretation of medieval field boundaries on Holne Moor, E Dartmoor, it may be wondered whether their chronological sequence of boundaries, based on morphology, would be repeated elsewhere on Dartmoor. Seven types of boundary were identified on Holne Moor, arranged in the following chronological order: reave, block wall, clearance wall, corn-ditch, hedge-bank, wall-bank and wall, amended here to "coursed wall". (defined above p.105) (Fleming and Ralph 1982, 104-7) All are found in UPV and frequently occur within each field system in the same chronological order.

Thus reaves still form a prehistoric foundation, upon which the Medieval systems were superimposed. The Willings Walls contour reave, **Mon 540**, was certainly reused by Medieval farmers and possibly in the Hentor coaxial field system. Parts of the Eylesbarrow watershed reave, **Mon 271**, were refurbished or dismantled to facilitate stock control.

The position of block-walls within the chronological sequence in UPV is difficult to assess. By the nature of their construction, it is difficult to interpret relationships with other types of boundary. The block-wall, **Mon 920**, at Hentor is situated in the marshy area between the two major field systems and cannot be clearly associated with either. Another block-wall, **Mon 870d**, is part of the Phase I field system at Ditsworthy, and may be a survival of the initial enclosure, pre-dating other refurbished elements of the field system. However, the block-wall, **Mon 126**, at Trowlesworthy is within the Phase II field system and, therefore, not, as Fleming and Ralph found at Holne Moor, in the earliest Medieval phase. (1982, 106)

FN 1 The Devon acre = 5760 sq. yds. compared to the statute acre of 4840 sq. yds. (Finberg, 1969,30)

Horizontal stratigraphy and the overall plan indicate that clearance-walls represent the earliest phases at Gutter Tor, Hentor and Ditsworthy. Thus, Mons 676b and 630b are surviving remnants of the initial enclosure of Field A at Gutter Tor. The clearance-walls, Mons 577, 519 and 915 define the outer boundary of the first field system at Hentor, which is subdivided by clearance-walls, Mons 521, 523, 524 and possibly another turf-covered one, Mon 534a. The clearance-wall, Mon 728, which marks the Ditsworthy boundary is probably contemporary with the Phase I cultivated fields. Furthermore, the origin of clearance-walls, by which stone or clitter from a field was piled up into a rough boundary suggests an early date, corresponding with the initial enclosure of the farm. However, it should be noted that these clearance-walls are located in areas of dense clitter and, therefore, considerable stone clearance was required. It may then be misleading to assume, on the grounds of morphology alone, that clearance-walls are earlier than, for example, the hedge-banks on Ringmoor Down, where there is little loose stone or clitter.

It is occasionally difficult to distinguish a corn-ditch from a hedge-bank. For example, little stone revetment is visible in the early Trowlesworthy boundary, Mon 140, which might, therefore, be interpreted as a hedge-bank. However, the survival of some stones and the slightly asymmetric profile suggests that this is a corn-ditch.

On Holne Moor, corn-ditches defined the outer limits of "The Lobes", which comprised the earliest Medieval occupation in the study area. (Fleming and Ralph 1982, 107) The origin of the corn-ditch as the prescribed method of preventing deer from being trapped in cultivated fields, led Fleming and Ralph to suggest that their construction was restricted to the Forest period, that is, between the 11th century and the legal deforestation of Devon, which was accomplished between 1204 and 1239. (Fleming and Ralph 1982, 109) Thereafter, Fleming and Ralph suggest that thick hedges, wall-banks or wall-banks topped with hedges were favoured as a more effective means of excluding livestock and deer from cultivated fields.

In UPV, corn-ditches were also used to define the outer limits of parcels of enclosures, but they seem to have continued in use for a much longer period. The corn-ditch, **Mon 140**, which may accompany Phase I at Trowlesworthy and the corn-ditch, which defines the S side of Ringmoor Down almost certainly belong to the Forest period. Thus, according to documentary evidence, discussed in detail below (see pp 181 and 194), the first permanent occupation of Trowlesworthy dates to the early - mid 13th century, while the Ringmoor Down boundary was recorded as an old boundary in the late 13th century and may have been much earlier, possibly even dating to before 1086.

However, corn-ditches, **Mons 624b** and **629**, also bounded the Gutter Tor fields, B to F, belonging to Phase II of Ditsworthy Farm, which, it is suggested below, were not enclosed until the abandonment of Gutter Tor farmstead in the later 14th century. (see below p 197) Furthermore, if the boundary was constructed in response to the legal obligations of the Forest period, it would surely have completely enclosed the tenement. Instead, the E boundary of Ditsworthy is defined by the clearance-wall, **Mon 728**. This suggests that the corn-ditch was built simply as a response to the grazing of livestock on Ringmoor Down. Corn-ditches were also used in the Phase II field system at Hentor Farm, which, as suggested above, may belong to the period of reclamation, which took place in Devon after 1550. (see above p.160) Walls of regular coursed masonry face the external side of the SW boundary, **Mons 928b** and **c**, but the facing occurs only intermittently in the SE boundary, **Mons 923a** and **924**. However, the asymmetric profile of the latter suggests that it still follows the corn-ditch type of construction. Through lack of maintenance, or by original design, corn-ditches may not always have a continuous stone-facing; thus the coursed masonry, facing the corn-ditches at Holne "occurs in patches only". (Fleming and Ralph 1982, 105-6)

Furthermore, corn-ditches also surround the latest enclosures at Ditsworthy, **Mons 880a, b c** and the West side of **880f**, suggests that this type of boundary continued to be built until recent times; as suggested above, the small field, **Mon 880a**, was not enclosed until after 1904. (see p.151) Therefore, the corn-ditch clearly continued as a method of construction long after the Forest period in UPV. The limited use of the wall-bank in UPV may then be particularly significant. Thus, in contrast to Holne Moor, the corn-ditch may simply have been preferred to the wall-bank. Possibly, thick hedges were more difficult to establish on the wetter exposed slopes of the moor, though hedges of some antiquity lie atop the corn-ditches, which mark the UPV boundary on the N and W sides of Ringmoor Down.

However, if corn-ditches do not necessarily date to the Forest period, the converse may still be true: that is, that a settlement occupied in the Forest period had to be enclosed by a corn-ditch. Trowlesworthy fulfilled the obligation but the absence of a completely enclosing corn-ditch around the earliest phases of Ditsworthy, Gutter Tor, Hentor, and around the Ringmoor Down farms suggests that these all post-date the 12th century.

On Holne Moor, although "the most conspicuous" examples were late Medieval in date, hedge-banks originated in the earliest period of Medieval occupation. (Fleming and Ralph,1982,105) In UPV, hedge-banks may have a similarly long history. Perhaps the most akin to the Holne Moor archetypes are the large earthen banks with ditches on Ringmoor Down, for example, Mons 276a-e, 331, 332, 326, 335 and 340, which define areas of pasture and Mons 345a-f and 617a-c, which enclose cultivated fields. It is difficult to place these in a relative chronology because of their isolation from other types of boundary. However, hedge-banks occur in the Phase I field system at Ditsworthy and in Phase II fields at Gutter Tor/Ditsworthy as well as in the N Hentor field system, though here they are composed of a matrix of earth and stone.

The only clear example in UPV of a wall-bank, between fields, Mons 880f and 880g/h, at Ditsworthy must also be relatively late in date as part of the latest enclosures on the site. The boundary marking the western extent of Ringmoor Down may also be interpreted as a wall-bank as it is faced on both sides with stones. However, this low bank with an intermittent facing of large stones is quite distinct from the Ditsworthy boundary, which consists of a double wall of regular coursed masonry with a substantial core of earth and rubble in between. It may, therefore, be an early example, possibly resulting from the maintenance of a hedge-bank, which Fleming and Ralph suggest, is a possible process by which the wall-bank developed. (1982, 104)

"Coursed walls", defined as free-standing dry-stone walls, are still found at the other end of the sequence and surround the most recent enclosures at Trowlesworthy but they also occur in the Phase II system at Hentor (Mons 835c, 838b, 840c, 841c, 843 and 848) and, therefore, might date to the 16th or 17th centuries..

Thus, it has been shown that the Holne boundary types all occur in UPV, but do not perhaps fit so closely into a relative chronology. Notably, corn-ditches seem to have continued to be built later than at Holne. Furthermore, some variation in composition may be demonstrated: earthen banks, similar to Holne hedge-banks, occur, for example on Ringmoor Down, but more banks, such as at Ditsworthy, Gutter Tor and Hentor, are composed of a matrix of earth and stone. The composition presumably reflects the amount of surface stone in the vicinity or the re-use of prehistoric boundaries.

d) Farmsteads.

i) Function.

In the absence of excavation, the function of individual structures within the farmsteads is not immediately clear. Indeed function is not always easily determined after excavation: for example Austin (1985, 78) challenges Beresford's interpretation (1979, 134) of structures 5, 6, and 2 at Hound Tor 1 as "houses" for domestic occupation. Austin (1985, 72), probably correctly, considers that simple traces of burning without, for example a stone setting, do not provide sufficient evidence for a domestic hearth and therefore interprets those as outbuildings. Furthermore, survey and often excavation will only detect the final use of a structure rather than "floruit" use and requirements may have changed through the lifetime of a settlement. Thus the two structures, serving as house and byre in the final excavated phase of occupation on the Medieval farmstead at Dean Moor may originally, as Austin suggests, have had reversed roles. (Austin 1985, 77; Fox 1958, 144-9)

Austin (1985, 76) selected six criteria, with which to identify a longhouse within a farmstead: the presence of drains, indicating the byre or shippen, the presence of separate domestic arrangements, the presence of hearths outlined by burnt stones, and the presence of cooking pits will only be found after excavation. However two others, the presence of a cross-passage dividing the dwelling area from the byre and the presence of a sub-divided dwelling space or annexes "which demonstrate complex arrangements of habitation", may be detected from surface remains. *(ibid)*

Structures which display at least three of these internal characteristics are interpreted as longhouses. *(op.cit., 77)* Austin *(op.cit., 76)* then made a further subdivision according to internal length. Thus longhouses within the excavated sites in the SW, which measure 14m-23.1m (46-76ft.) are classed as principal longhouses, Type 1. Other structures which fulfil the criteria of longhouses but only measure 9.5m - 11.9m (31 - 39ft.) are classed as subsidiary longhouses, Type 2. A third group of structures which display some of the longhouse characteristics but are shorter than all the longhouses are classed as subsidiary dwellings, Type 3. Finally, structures with none or occasionally one of the longhouse criteria, and measuring 6.9m - 12.2m (20 -40 ft.) are outbuildings, Type 4.

Table 3:4 illustrates the size and internal characteristics of the structures in the UPV farmsteads. Even with the reduced number of internal characteristics visible in these unexcavated sites, the longhouses immediately stand out. The sizes of Spanish Lake, Shavercombe, and Shavercombe Foot fall well within the range of principle longhouses. A cross-passage is only visible, at present, at Spanish Lake, but the provision of an inner compartment at the uphill end of the other two implies the sub-division of a dwelling space. In any case, as these are the only structures on the three farmsteads, they are most likely to fulfil a domestic function. Another single structure farmstead, Dinna Clerks in Widecombe-in-the-Moor, is closely comparable in size. Measuring 16.78m long (55 ft.) and 3.36m - 4.27m (11 -14 ft.) wide, and featuring a cross-passage and an inner room, it is particularly similar to Spanish Lake (and also Legis Lake). (Beresford 1979, 135; Austin 1985, 74). Other examples of single-structure farmsteads were recorded by Linehan at Blackslade, Widecombe-in-Moor, Blackalder, Shaugh Prior and at Parkland Newtake, Cornwood. (1966, 228 Figs 48b+c, 136-7 Fig 57f)

Table 3;4 Table of Dimensions and Internal Characteristics of UPV buildings (based on Austin, 1985, 74 Table 7;1)

SITE	MON	INTERNAL LENGTH	INTERNAL WIDTH	DWELLING LENGTH	INNER COMP LENGTH	BYRE LENGTH	OPPOSED DOORS	UPPER ROOM	ANNEXE
Spanish Lake	543a	17.2m	3 - 4m	10.0m	2.80m	6.20m	X	X	
Willings Walls	593a	6.5m	3.4 m						
Shavercombe	975	18.2m	c.3.2		5.40m			X	X
ShavercombeFoot	991a	16.6m	4.8-4.5m		3.7m			X	XX
Ringmoor Down	344c	13,6m	3,0m	7,4m	c,2,5m	5,00m	X	X	X
	344e	7,6m	3,8m				X		
	344i	10.2m	3.2m				X		
Legis Lake	315e	16,6m	3,4-4,0m	7,8m	2,90m	7,40m	X	X	
	315a	c,6,4m	3,9m						
	315f	5.6m	2.7m						
Legis Tor	325c	?13,6m	6,0m						
	325d	?	6,0m					?X	
	325e	?	2,4m						
	325g	?	2.4m						
Gutter Tor	677a	c,20m	c,3-c,4m		5,2-3,8			XX	
	677b	10,1m	4,5m						
	677c	8,4m	2,8m						
	677d	9.8m	3.0m						
Whittenknowles	786	26,3m	2,5-4,0m	17,2m	5,6-3,6	8,30m (from cross-passage)	X	XX	X
	785	7,0m	3,3m						X
	787	12.5m	3.0m						

Although slightly short at 13.6m, **Mon 344c** is the longest of the three structures at Ringmoor Down farmstead and may still be interpreted as a principal longhouse. The cross-passage and inner room support this identification, while the structure, **Mon 344g**, may be interpreted as an annexe. The similarity in size and plan of the Legis Lake principal longhouse, **Mon 315e**, to Spanish Lake and Dinna Clerks has already been noticed. The poor preservation of Legis Tor farmstead makes identification of function almost impossible and the original internal lengths cannot be assessed.

With an internal length of 26.3m, Whittenknowles is longer than any of the excavated examples in the SW, listed by Austin (1985, 74) or unexcavated examples on Dartmoor, recorded by Linehan. (1966) However, the morphology and slightly trapezoidal plan is similar to some of the larger examples, such as house 3 at Houndtor 1 (Beresford 1979, 132-3) and building A1 at Okehampton Park 59. (Austin 1978, 204-5) With an internal length of about 20m, Gutter Tor also belongs in category 1B of the larger principal longhouses. However, the composition of this building, incorporating very large groundfast boulders is quite distinct.

At Willings Walls, no internal characteristics of the longhouse can be detected, though some may be revealed by excavation. However, it is the only building on the site and, therefore, a domestic function may be assumed. Measuring only 6.5m, Willings Walls is too small to be a longhouse and does not appear to combine a dwelling and byre. Therefore, it seems to fall into the category of secondary dwelling. Other examples of these Type 3 buildings are listed by Austin. (1985, 74) However, the "house" at Dean Moor (Fox 1958, 144-5), building 2 at Treworld (Dudley and Minter 1966, 44-5) and building 1 at Tresmorn (Beresford 1971, 62) all combined the functions of dwelling and byre, while the former two as well as house 4 at Houndtor 1 (Beresford 1979, 132-3) were associated with principal longhouses and therefore clearly merit the term "secondary dwelling". Hemery (1983, 203, 50) suggests that it could have been occupied by a forester (ie. gamekeeper) in accordance with the order of 1354, that foresters were to live on the Moor during deer-calving, to deter poaching. This seems unlikely as Willings Walls is outside the Forest of Dartmoor proper. Alternatively, Price's suggestion (1980, 86) that it was occupied by tin workers, is plausible, considering the proximity of tin streamworks, though the house seems rather more carefully built than other early tinners' structures, such as, **Mons 1082a-d**. Possibly the closest parallel in function to Willings Walls is the small single-compartment building at Vaghill, also the only structure on the site. Its situation on a warren surrounded by pillow mounds suggested to Linehan that this was the home of a warrener. (1966, 132) Willings Walls is certainly situated within a warren, but distance from any pillow mounds suggests association is unlikely. However, a connection with pastoral activities may be the best interpretation. Willings Walls may have been the summer residence of a shepherd or stockman similar to those on the Forest proper, described by Fogwill. (1954, 107)

Hentor House is also quite distinct from the other dwellings; it appears to be a lobby-entry type of house, possibly originally with an upper storey. The lobby-entry house, popular in eastern England, appeared in Devon in the 17th century, though mostly in the eastern part of the county. (Child 1990, 44) It evolved from the single-function, ie. solely domestic, cross-passage house, and, therefore, its appearance on Dartmoor, an area dominated by the longhouse tradition may be unusual. (Mercer 1975, 60-1) It may, therefore, be suggested that Hentor House was built by an incomer, either landlord or tenant, with connections in eastern Devon or even eastern England.

Structures, **Mons 315a** and **f**, at Legis Lake, **Mons 677b,c** and **d** at Gutter Tor and **Mons 785** and **787** at Whittenknowles all seem to correspond to Type 4 outbuildings. The function of **Mons 344e** and **344i** at Ringmoor Down is less clear. The opposed doors in both structures may indicate a division between dwelling and byre. **Mon 344i**, measuring 10.2m long, could fall into the category of subsidiary longhouse but, at 7.6m long, **Mon 344e**, is too short , and may be best interpreted as an outbuilding. It might be supposed that at least one structure out of three must be an outbuilding. Support for this identification may be found at Okehampton Park 59: the opposed doors at structure A2 were found not to be at either end of a cross-passage, indicating that this was not a longhouse. (Austin 1978, 206-8; Austin 1985, 74) Obviously, excavation would greatly aid interpretation.

ii) Morphology.

Some variations in morphology among the UPV farmsteads may be observed. Most of the farmsteads have been built of coursed dry-stone masonry. However, two farmsteads, Legis Tor, **Mon 325**, and Gutter Tor, **Mon 677**, are quite distinct morphologically. Thus the Gutter Tor structures are composed of very large boulders, contained in minimal banks, while Legis Tor farmstead consists of very broad grassed-over banks, in which little stone is visible on the surface or revealed by probing. It may be suggested, therefore, that a major component of construction was turf, defined as "slice[s] of grass and earth" or sods. (Evans 1969, 80)

Thus at Gutter Tor farmstead, the gaps between the large boulders may originally have been filled with sods, which have subsequently disintegrated and eroded. It is further possible that the earthen spread at the eastern downslope end of the longhouse, **Mon 677a**, represents the slump of the earthen component of the walls. (see Fig.3:14) A turf wall can disintegrate without trace (Evans 1969, 87), particularly in such an exposed location and where the incorporation of large boulders in the banks might inhibit the growth of a protective grass cover. By contrast, much of the earthen component of Legis Tor farmstead seems to have survived. While a considerable amount of stone may have been robbed in construction of the Legis Tor boundary wall, **Mon 197a**, the present earthen banks are surely a feature of the original construction rather than a product of its destruction. Therefore, any stone content may have been simply used in revetment, such as an inner lining. A few stones on the inner face in **Mon 325e** may be the remnants of such a facing. The mat of grass, now covering the farmstead, presumably aided its survival, in contrast to the weathered banks at Gutter Tor.

Evidence for Medieval turf structures in SW England is limited and not unequivocal. Turf walls, lined with wattle and sometimes later with stone, were claimed to have preceded most of the stone buildings at Houndtor village, Houndtor farmstead, Hutholes and Dinna Clerks, all in E Dartmoor. (Beresford 1979, 112-124) A pre-stone turf phase was similarly postulated at Tresmorn and Treworld, both in N Cornwall. (Beresford 1971, 57-8; Dudley and Minter 1966, 39-41)

However, the only evidence of a turf wall is "a layer two turves thick" and 4ft wide in the area between the stone houses 1 and 2 at Houndtor. (Beresford 1979, 177) Otherwise the evidence rests on the numerous stake-holes, which were interpreted as having accomodated a wattle-lining. The turf walls could certainly, as Beresford suggests, have been removed and spread on the fields or could simply have disintegrated. (*ibid.*) However, in a review of the evidence from Houndtor, Austin (1985, 72-3), suggests that the stake-holes are just as likely to be contemporary with the stone phase, while the apparently associated floors could have occurred naturally. Thus the numerous stake-holes at Okehampton Park 59 were found, with one exception, to be associated with the stone buildings and were interpreted as renewals, possibly made annually, of animal stalls or hay racks. (Austin 1978, 203-214; 1985, 71) Only at Tresmorn do the stake-holes define rectangular structures "spatially apart from the cob and stone houses". (Preston-Jones and Rose 1986, 148) Furthermore, it is possible that the single extant slab of turf at Houndtor derived from the roof, in the same way that rectangular "chocolate-coloured patches of soil" at Mawgan Porth, Cornwall were interpreted as roofing turves. (Bruce-Mitford 1956, 175)

Therefore, apart from Tresmorn, the evidence is perhaps insufficient to substantiate a pre-stone phase of wattle-lined turf buildings on most sites. However this does not completely rule out the use of turf as a building material. An intermediate phase was identified at Hutholes, Dartmoor and at Treworld, Cornwall, in which the previously wattle-lined turf walls were faced with stone. Although reservations were expressed on the wattle-lined phase, it may still be possible to interpret the two lines of stones in phase 3 of House 3 at Hutholes as the inner and outer facings of a turf wall on the West and North sides respectively, though no turf survives. (Beresford 1979, 122-3, Fig. 11) Furthermore, in House 1 at Treworld, "turf filling" was discovered in a 7ft-length of stone-faced wall, which had been incorporated in a later wall, though whether this constitutes a whole structural phase is questionable. (Dudley and Minter 1966, 41) Nevertheless, it demonstrates some use of turf in construction. In addition, in the longhouse at Lanyon, Cornwall, the two side walls and the upper end wall consisted of alternate courses of stone and turf. (Wilson and Hurst 1965, 208-210) More recent excavations on Bodmin Moor have identified further examples: a stamping mill at East

Colliford built of stone-faced turf walls and an unrevetted turf-built tinners' shelter at Redhill Marsh. (Austin *et al* 1989, 123-132)

Therefore the use of turf as a building material is paralleled in the SW, as well as in other parts of the country. (Parallels in Scotland, Ireland, Isle of Man and North America are listed in Beresford 1979, 112-5) Furthermore another of Austin's objections to the proposed use of turf in the construction of houses, that it would have used up so much hard-won cleared pasture, may not be so relevant on Ringmoor Down. (Austin 1985, 72) This pasture, on underlying metamorphic rock, would never have required so much clearance as on the clitter-strewn areas on granite. Therefore there seems no reason why turf could not have been cut on Ringmoor Down and used in conjunction with boulders at Gutter Tor farmstead and with a stone facing at Legis Tor farmstead.

iii) Date.

The date of the UPV farmsteads cannot be determined from surface indications alone. The conservatism of rural building allowed the basic longhouse design to continue in use for centuries. Evidence from excavated sites in the SW suggests that longhouses on deserted sites are restricted to a relatively narrow chronological horizon of perhaps two centuries from the 12th to the 14th centuries. However, a few notable exceptions suggest that other sites, such as those in UPV, can only be assigned to this period with caution. Thus the contrast in pottery assemblages from Houndtor village and farmstead suggests that the latter site may not have been colonized until later, possibly in the late 14th century. (Beresford 1979, 150) The ceramic evidence from Garrow Tor, Bodmin Moor indicates that occupation began in the 13th century but continued until the 15th century or, as Preston-Jones and Rose suggest, the 16th century. (Dudley and Minter 1962-3, 285; Preston-Jones 1986, 148) Furthermore, two longhouse sites, admittedly not on moorland but on the N Cornish coast, originated before the 12th century. Thus the site at Mawgan Porth was dated by pottery and a silver penny to the 10th or 11th centuries (Bruce-Mitford 1956, 182) and the settlement at Tresmorn, otherwise dated by pottery to the 12th to the 14th centuries (Beresford 1971, 67), may be of pre-conquest origin "from its context in the local pattern of settlement", (Preston-Jones and Rose 1986, 150) Therefore, although excavation evidence has identified a phase of moorland occupation between the 12th and 14th centuries, some variation may be revealed on individual sites

3.3 DOCUMENTARY EVIDENCE

3.3.1 Introduction.

Documentary evidence for Medieval farming in the Upper Plym Valley divides into three main parts. Firstly, the Domesday Book may throw some light on the ownership and land use of the valley in the Saxon and Early Norman periods. Secondly, a series of title deeds for Trowlesworthy documents owners and occupiers of this tenement from the 13th to 18th centuries. Thirdly, the 13th century foundation charters of Buckland Abbey indicate that the N bank of UPV was included in the Abbey's estate; details of land use can be extracted from leases issued for parts of northern UPV by the Abbot of Buckland and by his secular successors after the Dissolution

3.3.2 The Domesday book.

The settlements and lands of UPV are not specifically mentioned in the Domesday Book, but this does not necessarily imply that the area was completely unused in 1086. After the Saxon Conquest of Devon, which was accomplished between *c.* 660 and *c.* 720 (Stenton 1945, 72; Hoskins 1952b, 298-9), it appears that the whole county was divided up into large territories, recorded in charters from the 8th century onwards. (Hoskins 1952b, 305; Finberg 1963) These were gradually sub-divided, often before the Norman Conquest and it is likely that moorland areas, such as UPV, surrounding the Royal Forest of Dartmoor, were included in this division of territory. (Hoskins 1952b, 305) In an example close to UPV, the W half of Meavy parish was included in a large estate recorded in a charter of 1031. (Finberg 1963, 14;1960, 30-2) It may therefore be possible to attribute UPV to a manor or manors named in the Domesday Book.

For this purpose, later documentary sources are particularly useful, notably the foundation charters of Buckland Abbey, discussed in detail below. (see p.192) On the death of Baldwin de Redvers, 8th Earl of Devon, in 1262/3 the manors of Buckland, Bickleigh and Walkhampton and the hundred of Roborough were held by his mother, Amicia (widow of

Baldwin de Redvers, 7th Earl), "rendering yearly to the guardian of the said earl's lands 100 marks". (Cal.Inq.PM., i, 176, No. 564). In 1273, Amicia acquired these manors and other property from her daughter, Isabella di Fortibus, heir to the de Redvers fortune. (Brooking Rowe 1875, 374). In 1278, Amicia founded a Cistercian house, St Benedict's of Buckland and bestowed on it "our manor of Bocland (Buckland), and our manors of Columpton (Collumpton), Bykeley (Bickleigh), and Walkampton (Walkhampton), with the advowsons of the churches, and with the hundred of Rugheberewe (Roborough)". (Brooking Rowe 1875, 353)

The boundaries were outlined in a further deed by Amicia (translated in *op.cit.*, 354-356) and confirmed in a charter by Isabella di Fortibus in 1291, after her mother's death. (translated in *op.cit.*, 356-359) These demonstrate that, at least as early as the 13th century, UPV, N. of the R. Plym and up to the forest boundary lay within the manors of Buckland, Bickleigh and Walkhampton. (fig 3:18)

a) <u>North Bank of the R. Plym</u>

Identification of the particular manor, to which North UPV belonged is difficult, as the Abbey charters only describe the boundary of the area as a whole. (Fig.3:18) However, some help is provided by the evidence elsewhere that "many a parish became territorially co-extensive with a manor". (Finberg 1969, 19; also Hoskins 1952b, 295; 1963, 36) It is clear that the manors of Buckland, Bickleigh and Walkhampton occupy approximately the same positions as the ecclesiastical parishes which bear their name. Thus the Abbey boundary defined by the R. Walkham in the N., mostly corresponds to the N. and W. boundaries of the parishes of Buckland and Walkhampton respectively. In the E., the Abbey boundary is co-terminous with the Forest of Dartmoor, and equates with the eastern limit of Walkhampton parish. The Abbey boundary also follows much of the Meavy parish boundary and the S. boundary of Sheepstor parish, marked by the R. Plym, both of which are discussed in detail below. (see pp194-5) Finally, in the W., the Abbey boundary replicates the W. boundary of Buckland parish along the R. Tavy. It is possible that the boundaries between the manors of Buckland and Bickleigh, and between Buckland and Walkhampton also approximately follow the parish boundaries.

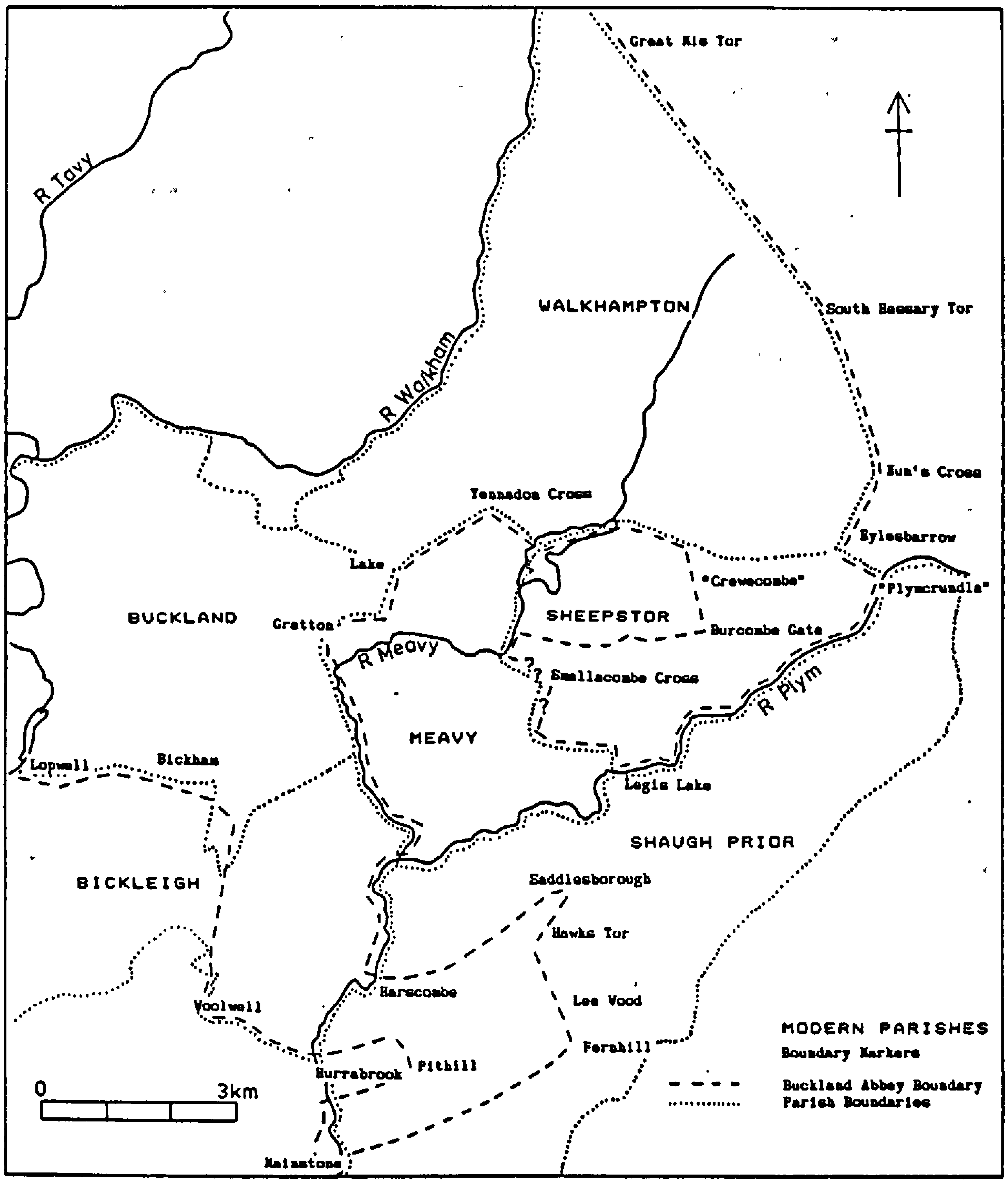


Fig. 3:18 The boundary of Buckland Abbey

However while parish boundaries adopt much of the manorial boundaries, particularly along rivers, only Buckland manor corresponds closely to its parish. Bickleigh manor includes only the eastern portion of its parish, while also taking in a chunk of Shaugh Prior parish. In Domesday Book, the area later covered by Shaugh Prior parish, is occupied by a multitude of manors, and therefore the Shaugh Prior parish boundary may not be of great antiquity. This anomalous parish boundary may explain the later descriptions of the Bickleigh holding as "Byckleght cum Shaght", which may be interpreted as Bickleigh manor with its appurtenant estate in Shaugh (Prior) parish. (Valor Eccles. 1810-34,ii,378)

Another departure from the later parish boundaries occurs at Sheepstor. The Abbey boundary excluded the village and tor of Sheepstor, which cover about one-third of the present parish of Sheepstor. The "lands and villeins of Torr at Schitestor" [Sheepstor] were also granted to Buckland Abbey, but were listed separately and were not, in 1278, part of Buckland, Bickleigh or Walkhampton manors. (Brooking Rowe 1875, 356) However, one of these manors must have included the remainder of the later parish of Sheepstor, including northern UPV. It might be concluded that the whole of Sheepstor parish was once part of one of these manors, but that at some stage a separate manor was created around the village and tor by a process envisaged by Hoskins:

> "These large estates were subsequently carved up, especially at their edges. In due course these marginal areas acquired a church of their own, as the work of colonization proceeded and the population grew, and sooner or later they were elevated to the status of separate ecclesiastical parishes." (1952b, 295)

In this case, the area would have been enlarged later into the present ecclesiastical parish of Sheepstor.

Examination of the map suggests that the area covered by the later Sheepstor parish is most likely to have belonged to the adjacent Walkhampton manor. In this case, after the separation of Sheepstor parish, the Walkhampton boundary would have been re-drawn along Deancombe Brook to Eylesbarrow.

However a simple geographical solution is complicated by ecclesiastical history. Thus, "as the church [at Sheepstor] was a chapel dependent on Bickleigh, it may be inferred that it was originally a freehold within the manor of Bickleigh." (Reichel 1930, 118) As Hoskins points out, "a mother church almost invariably represents a parent settlement." (1952b, 301) Indeed, Sheepstor church was still associated with Bickleigh until it was separated and endowed by Sir Massey Lopes in the 19th century. (Breton 1911, 34) Subsequent documentary sources support this. For example, the lands of Tor at Sheepstor, granted to Buckland Abbey, are described in Amicia's deed as "adjoining the manor of Buckeleye" and in Isabella's charter as "lying near to the manor of Bykelie". (Brooking Rowe 1875, 356, 358) Sheepstor is separated from Bickleigh proper by Meavy parish, but this description would be appropriate if the remainder of the later parish of Sheepstor, was part of Bickleigh Manor.

More conclusive is the 1493 lease for the tenement at Derkysworthy [Ditsworthy], discussed in detail below. (see p.198) This grants "all that tenement at Derkysworthy in our manor of Bykelegh". (WDRO 70/183) A 1676 lease for "Dittisworthy Warren", also discussed below is endorsed with the words "mainour of Bickleigh". (see p.260) (WDRO 70/189)

Therefore, it may be concluded that N. UPV belonged to Bickleigh Manor. It may be assumed that the manors granted to Buckland Abbey in 1278 had not altered significantly since Domesday. These manors had been held by the de Redvers family since *c.* 1100 when Henry I awarded the Barony of Plympton along with Tiverton and the Earldom of Devon to Richard de Redvers for his loyalty during the accession crisis. (Rose-Troup 1905, 207) (FN 1)

The Honour of Plympton consisted of a great number of manors spread all over Devon, mostly confiscated from their previous Domesday owners. (Thorn ed. 1985, pt 2, ch 21) Bickleigh, in 1086, was one of the many manors in the fief of William of Poilley, which either by forfeit or default seceded wholly to the Honour of Plympton. (Thorn ed. 1985, ch 21).

FN 1. There is some confusion over the initial grant of the Earldom of Devon. Reichel's claim (1930, 117) that Richard's son, Baldwin was created 1st Earl in 1141 is followed by the most recent editors of the Domesday Book. (Thorn ed. 1985, pt 2, ch 21) However, Reichel (1897, 457, FN 8) had previously stated that Richard was created 1st Earl by Henry I. This is perhaps more likely if his further claim is correct that Baldwin was in exile between 1136 and 1154. (*ibid.*; Rose-Troup 1905, 207)

It paid tax for one hide and contained eight ploughlands. (*op.cit.* 21,19) The demesne farm consisted of one virgate, two ploughs and seven slaves. The remaining three virgates were occupied by seven villagers [*villani*] and four smallholders [*bordari*] with three ploughs. Assets consisted of "a fishery which pays 5s", four acres of meadow, an area of pasture one league long and four furlongs wide, and a tract of woodland one league long and one league wide. Livestock comprised six cattle, five pigs, 146 sheep and 14 goats. Between 1066 and 1086, the value rose from 20s to 40s. Before 1066, Bickleigh was held by Brictmer, thus extending the history of N. UPV back into Saxon times. (*ibid.*)

It remains to determine how UPV is disguised within this abbreviated Domesday description. (see below secton 3.4.2).

b) South bank of the River Plym.

Identification of a manor, to which UPV, S. of the Plym belonged, is more difficult. The S. bank, or at least, Trowlesworthy, must have belonged at some stage to the de Redvers family because this land was granted in the early 13th century by Baldwin de Redvers to Sampson de Trailsworthy. (WDRO 710/1; see below p.181) It is likely that this land was acquired by the de Redvers family in *c.* 1100 as part of the Honour of Plympton.

No manor, apart from Bickleigh, found by the editors of the Domesday Book to have been given later to the Honour of Plympton, adjoins the S. bank of UPV. (Thorn ed. 1985, pt 2, ch 21) Otherwise southern UPV is surrounded by holdings belonging to other fiefs. Boundaries are unknown; however, the two Shaugh manors in the Domesday fief of Iudhael of Totnes, were probably bounded on the W. and N. by the Plym, and may even have extended eastwards to Blacka Brook. (Thorn ed. 1985, 17,100-01) Iudhael held other property in Shaugh Prior parish including Pithill, Coldstone, Fernhill and Brixton Barton as well as property in Meavy parish including Meavy, Hoo Meavy, Gratton and Goodameavy. (Thorn ed. 1985, ch 17) Thorn suggests that the latter included Cadworthy and Brisworthy, the farms directly across the R. Plym from Trowlesworthy. (*op.cit.* pt 2, 17,78-82) To the SE, Cornwood belonged to the Earl of Mortain (*op.cit.* 15,36)

Subsequent history is no more illuminating. The Barony of Totnes was confiscated from Iudhael, but then awarded in its entirety to Roger de Nonant in 1087. (*op.cit.* pt 2, ch 17) By the early 13th century, Cornwood belonged to Guy de Brittevilla and included land at Cholwich and common pasture extending as far as a line drawn from the head of Tory Brook to Yealm Head. (Hoskins 1952a, 79) Significantly, this corresponds more or less to the watershed boundary of the S. bank of the R. Plym. A later charter issued in 1411 to the Cholwich tenement, granted common pasture on the moor between the R. Yealm and the R. Plym. (*op.cit.* 83) However, the original manorial boundaries may have been altered by then.

Apart from Bickleigh, the only association with the de Redvers family in the vicinity is Lovyeton [Lovaton] in Meavy parish, which was in the fief of Robert Bastard in 1086 but later held by Ralph de Cilterne from the Honour of Plympton. (Thorn ed. 1985, 29,9) Therefore, a possible conclusion is that UPV, S. of the Plym and up to the forest boundary, was also once part of Bickleigh manor. The manor may have continued across the R. Plym to the watershed, presently marking the SE. boundary of Shaugh Prior parish. In the early 13th century Trowlesworthy was sliced off to become a freehold tenement (WDRO 710/1; see below p.181), and the boundary was then redrawn along the R. Plym, as described in the Buckland Abbey charters. However, if southern UPV belonged to Bickleigh Manor, it is not clear why the remainder of the S. bank outside Trowlesworthy was not included in the grant to Buckland Abbey.

Alternatively, there is some evidence to suggest that other land in Shaugh parish, outside the boundary of Bickleigh manor drawn in 1278, belonged to the Honour of Plympton. In Amicia's and Isabella's charters the eastern boundary of the Shaugh component of Bickleigh manor appears to be from "Haneketorr [Hawk's Tor], and thence towards the west and north through the land of Farnhill [Fernhill] to Maynstonktown [Mainstone] and Maynstoncross." (Brooking Rowe 1875, 355, 357; Burnard and Prowse 1893, 497)(see fig 3:18)

However, a line directly from Hawks Tor to Fernhill would then exclude a wood, which according to another charter was de Redvers property. Thus, Isabella di Fortibus granted to the Burgesses of Plympton, the rights granted by her father "in the turbary of our moor towards Dartmoor and all necessary fuel ... in the first and accustomed paths in the wood of Heawood and beyond." (Brooking Rowe 1887, 560) This, according to Brooking Rowe, refers to Lee Wood, presently divided into Higher and Lower Lee wood by Lee Moor China Clay works (OS 1:10,560), but possibly in the 13th century comprising one large tract of woodland. (*op.cit.* 561) This grant is undated but was presumably issued after Isabella had inherited the de Redvers property. By that time, her mother already held the Manor of Bickleigh. (Cal.Inq.PM., i, 176, No 564) Thus Lee wood is likely to have been outside the manor.

Therefore, it may be concluded that, after *c.* 1100 a tract of land belonged to the Honour of Plympton, which contained "our moor towards Dartmoor" and "Heawood and beyond" and, skirting Shaugh Manor, may have extended along the S. bank of the R. Plym, including Trowlesworthy, as far as the Cornwood boundary in the SE and the Forest of Dartmoor boundary in the NE. This may have comprised common land of pasture or woodland for the use of tenants of the Honour of Plympton. In 1086, it would also have been common land possibly appurtenant to the fief of William of Poilley.

3.3.3 Trowlesworthy.

a) Introduction

While some inferences on ownership and land use in the Upper Plym Valley, in the Saxon and early Norman periods, can be made from the Domesday Book, more specific information is available in title deeds. It is particularly fortunate that a series of 24 deeds recording conveyances, leases, mortgages and marriage settlements dating from the early 13th to the 18th centuries, survives for Trowlesworthy Warren.(FN 1) (WDRO 710/1 - 710/23, 710/126, 710/748)

FN 1. The documents refer variously to Trailsworthy, Traylysworthy and Trailisworthy but the modern form of Trowlesworthy is used here unless quoting from the documents.

The application of these references to the field evidence is limited, as most adhere to the prescribed legal formulae. Some deeds refer simply to, for example, "all the land of Traylyswurthy" (WDRO 710/1, 710/748) or "messuages land and tenements in Traylesworthy" (WDRO 710/5), while a seemingly detailed description of the property, such as "all those messuages lands tenements meadows pastures and grazings woods underwoods rents reversions and services" (WDRO 710/9) is not necessarily an accurate inventory of all the assets of Trowlesworthy, but simply a legal convention to prevent any omissions.

Nevertheless, some details do emerge; thus it is possible to date approximately the changeover from farming to warrening, with implications for the archaeological remains, (see below p.255), while sufficient details of the boundary are recorded to enable it to be traced in the field. (see below p.182) However, the main contribution of these documents is their disclosure of the ownership and occupation of Trowlesworthy, from which inferences can be made on the history of land use. Other details, such as the privileges enjoyed by the "chief lords" or the rights, which accompanied property in sales or leases, also provide an insight into the organization of agriculture in the period. The function and form of the title deeds is described in Appendix B.

b) <u>13th Century</u>

The deed of gift of "all the land of Traylyswurthy" from Baldwin de Riparis [de Redvers], Earl of Devon to Sampson de Traylysworthy is the earliest in the series. (document extract 1) (WDRO 710/1, 710/748) This deed is undated but has been placed in the late 12th century by the West Devon Record Office on the evidence of palaeography. It would, in any case, have to fall within the range of dates between 1107 (succession to the Earldom of Devon by the first Baldwin de Redvers) and 1262 (death of the last Earl of Devon with the name of Baldwin de Redvers). (Rose-Troup 1905, 207, 216) A late 12th century date would neatly correspond with the suzerainty of Baldwin de Redvers II, who was fourth Earl from 1162 to 1175. However this date may be too early for one of the witnesses, Thomas of Challeswiche. Thomas did not succeed to Cholwich until after the early 13th century. He was in possession by 1249 but the estate was first granted to his father in a charter dated by palaeography to between 1200 and 1230. (Hoskins 1952a, 82, 79) If correct, the Trowlesworthy deed of gift would then date to between 1217 and 1262, the Earldoms of Baldwin IV and V, 7th and 8th Earls of Devon. (Rose-Troup 1905, 214-5) Therefore, an early - mid 13th century date may be more accurate. Presumably the clerk who wrote the document at that time could have learnt his craft in the late 12th century.

This deed is of particular interest as it includes a detailed description of the boundary, reiterated in several later title deeds. (see document extract 1) (WDRO 710/5-6, 710/8, 710/14-15) In this 13th century description, the "Plime" and "Blackabroke" are easily recognizable and thus formed the N, W and S boundaries of Trowlesworthy. The NE boundary was formed by "Eastorbrooke", which is an old name for Spanish Lake. Thus, a 17th century list of tinworks refers to Yeasterbrooke, when Spanish Lake is clearly intended (WDRO 72/1034), and a plan of Trowlesworthy Warren in 1842 labels Great Trowlesworthy Tor as "East or Trolsworthy Tor". (WDRO 710/203)

It might be suggested that Spanish Lake is ultimately derived from "Penickes Lake", which also contributes to the Trowlesworthy boundary. (FN1) Spanish Lake in UPV is not discussed in The Place-Names of Devon, but early forms of Spanishlake Cottage in Doddiscombsleigh parish include "Eastpinishlake" in 1672 and "Spynishlake" in 1687. (Gover *et al* 1932, 495) However, with reference to topography, the 13th century Penickes Lake must correspond to Cotor Brook, which originally flowed into the tributary of Blacka Brook, known to Haynes, simply as the South Boundary Brook (Haynes' Map TRO), but known in the 13th century as Thickstone Lake. Spanish Lake in UPV may still be a corruption of Penickes Lake, but applied to a different stream.

The configuration of the streams, forming the E boundary has been modified since the boundaries were first recorded. The construction of Phillips Leat, **Mon** 520, between 1833 and 1838 presumably cut off the route of Cotor Brook/Penickes Lake to the South Boundary Brook/Thickstone Lake. (Haynes 1976, 259-260) Haynes recorded the construction, in August

FN1 It is also written as "Pynekislake in 1437 (WDRO 710/5), Pynekkeslake in 1464 (WDRO 710/6), Pynckyslake in 1551 (WDRO 710/8) and Pynikeslake in 1589/90 and 1651. (WDRO 710/14-15)

1972, of the earthwork dam, **Mon X3**, to divert the water of Cotor Brook and Phillips Leat, back along the leat and into Spanish Lake. (Haynes Maps WIL 24, TRO 50; 1976, 259) This dam and its reed-filled reservoir are situated at the point where Cotor Brook was captured by Phillips Leat, before the latter's descent via Spring Tide to Big Pond at Lee Moor China Clay Works. (Sheet 3) The original course of Cotor Brook is no longer visible but has probably been swamped in this extremely boggy area. However, the original boundary mark, the confluence of Cotor and South Boundary Brooks, was probably near the present source of the South Boundary Brook. A deep gully, **Mon X5**, which appeared to have been recently-excavated in 1986, now by-passes the dam and allows water to flow directly from Cotor Brook to Spanish Lake.

Thus the S boundary of Trowlesworthy may have continued along the South Boundary Brook, to its present source at *c.* SX 5815 6422. The extent of the NE boundary was as far as the "well" (WDRO 710/1) or "flowing spring of Estorbroke" [*ad cursam fortis de Estorbroke*] (WDRO 710/748) Presumably, this refers to the source of Spanish Lake, which must have been near the W end of the gully, **Mon X5**, at SX 5826 6435. This boundary was also described as "through the middle of the turbaries of Eastor" [*per medium turbari[orum] de Estore*] (WDRO 710/748) Turbary may have referred to an extensive area, in which rights to cut turf were granted. However, *"turbarium"* can also mean "turf-pit" and thus refer specifically to an area of peat-cutting, such as that still visible at the source of Spanish Lake, and, through which the gully, **Mon X5**, has been excavated. (Sheet 3) (Gooder 1978, 168)

Finally, it is possible that the earthen bank, **Mon X4**, which fills the gap between the sources of the South Boundary Brook and Spanish Lake, is contemporary with the recording of these boundaries. Some antiquity is implied by its state of preservation; it is almost submerged in bog and is visible mainly as an "island" of firmer ground. It is marked on a 1842 map of Trowlesworthy Warren, and labelled "old mound". (WDRO 710/203) However, it is perhaps more likely to have been built only when complete enclosure was necessary, that is, when Trowlesworthy became a warren.

Other information on 13th century land management and the particular situation at Trowlesworthy emerges from a study of this deed of gift. Permanent transfer of freehold ownership is indicated by the clause, in which Baldwin grants the land to Sampson "forever" [*imperpetuum*]. (WDRO 710/748) However:

> "freehold in the modern sense did not exist in the Middle Ages, for all land was held of someone else who, in virtue of his lordship, was entitled to demand rent and service from its holder." (Miller and Hatcher 1978, xi)

Baldwin, as tenant in chief (or "chief lord"), held directly of the king and was required to provide knight service, or its monetary equivalent, scutage. (Holdsworth 1927, 25) The chief lord could muster the required number of knights by granting parcels of land in return for "knights' fees". For example, all the lands in Devon belonging to Isabella di Fortibus at the time of her death, were held "by the service of 89 knights' fees". (Cal. Inq. PM, III, 99) Within the Honour of Plympton, by 1262, Skytelestor [Sheepstor] had been granted for ½ knights' fee and Bastard' [Lovaton Bastard] for 3½ fees. (Cal. Inq. PM. I, 176) However, at Trowlesworthy, Sampson held the property of Baldwin by payment of a monetary rent ("chief rent") of four shillings *per annum*. This probably corresponds to free socage, though this particular term is not used in the title deed. (Holdsworth 1927, 28-9) However, socage is usually implied in a negative sense, that is, in the absence of evidence for the other forms of free tenure. (Holdsworth 1927, 28)

Subsequent resale of the property by Sampson (or his heirs) did not absolve his responsibility but simply introduced, by the process of subinfeudation, a further link into the chain of feudal obligation. (Dibben 1968, 4; see WDRO 710/2) By this means, the vendor (feudal superior) and ultimately the chief lord and the king retained some control over the property. Failure to pay the chief rent could result in repossession by the feudal superior.

As part of the agreement, the purchaser was granted "comon of pasture in all my wastes" and "housebote and folebote in my wood of Bikelegh" [Bickleigh]. "Housebote" was "the right to collect wood for the repair and building of houses" (Beds. County Council 1985, 34), and "folebote", written in later documents as "foldbote", presumably referred to the repair and building of folds or enclosures.

The omission of the phrases "messuage" or "tenement", terms which normally signify a house, might suggest that the property, in the early 13th century, consisted of land only. If this was so, the grant of housebote could have been for the initial construction of a house. It may be significant that a house is not mentioned in the deeds, specifically in relation to Trowlesworthy, until 1437. (WDRO 710/5) Prior to this, the deeds record the transfer in 1403 of only "three messuages" with land in five properties: "Tranaylysworthy Castorre Holrede Cadeworthy and Lulleworthy" (WDRO 710/3), and the lease in 1404 of "all [the] messuages lands and tenements in Tranaylesworthy Holrede Cadeworthy and Lulleworthy." (WDRO 710/4) This is hardly conclusive negative evidence; one of the messuages could easily have been at Trowlesworthy. However, a 1329 gift of a house and land in Lulleworthy is more persuasive. (WDRO 710/2) The grant, by the vendor, of housebote (for the house at Lulleworthy) from the "wood of T[ra]illesworthi", and "turbary in my moor of T[ra]illesworthi", supports the absence of an occupied tenement on the property, though this is still far from conclusive.

c) 14th Century

Some implications of the second deed in the series (WDRO 710/2) have already been noted. In this gift of 1329, Simon de Traillesworthi granted the house and land in Lulleworthy with attendant rights in Trowlesworthy to Richard de Hokeston. (FN 1) The consideration is not recorded, but arrangements for the chief rent are particularly interesting. "Three silver shillings" were required to be paid annually at the feast of St. Michael (29th September) for 20 years, after which the annual payment was to rise to 30 shillings. The purpose of this steep increase is obscure; it may have been designed simply as a protection against inflation or as a means by which the vendor might repossess the property when this demand could not be met.

It is highly likely that this Simon de Traillesworthi is the same person as, or the son of, the Simon of Travailesworth, who was a witness to the Charter of Isabella de Fortibus in 1291. (Brooking Rowe 1875, 359)

FN1 R.G.Haynes identified Lulworth with a farm near the Cadover to Shaugh road at approximately SX 552638. (Price 1980, 88)

This charter confirmed the endowment of lands to Buckland Abbey and the owner of Trowlesworthy would have been a natural choice for a witness; neighbours were often required to witness deeds to avoid any disagreements over boundaries. (Alcock 1986, 12, 62)

When Trowlesworthy next appears in the documentary record in 1403 it had been in the hands of John and Eleanor Halswill, though for how long, is not known.

d) 15th Century

Throughout most of the 15th Century, Trowlesworthy was wholly or partly owned by the Hulle family. A final concord of 1404 established the rights of Robert Hulle, Ralph Hulle, John Forest and John Jaycoke, "querents" or plaintiffs in the imaginary lawsuit, to "three messuages one hundred acres of land thirty acres of meadow two acres of wood two hundred acres of heath [*brueria*] 120 acres of heath [*jampna*] and two shillingsworth and 4 pennysworth rent with appurtenances in Tranaylysworthy Castorre Holrede Cadeworthy and Lulleworthy." (document extract 2) (WDRO 710/3) This description implies a distinction between two types of heath: *brueria* and *jampna*, though the two terms are barely distinguishable in the Medieval Word-List. (Baxter and Johnson 1934, 53,235) The document records that these rights were acquired as "the gift" of John Halswill and Eleanor, his wife, "deforciants" or defendants in the lawsuit for a consideration of one hundred silver marks". (£66 13s 4d).

Possibly financial hardship precipitated this sale. In the following year Robert Hulle, Ralph Hulle, John Forest and John Jaycoke leased "all their messuages lands and tenements in Tranylesworthy Holrede Cadeworthy and Lulleworthy back to the same John and Eleanor Halswill. (WDRO 710/4)

Rent and services due to the lessor are not recorded but the period of tenure is carefully outlined. The lease was granted until the deaths of John and Eleanor, their son Willi and his son John. Leases for three or four lives allowed considerable security of tenure and were particularly popular in S.W. England. (Alcock 1986, 40) The property could be held as long as any of the named persons remained alive.

However, usually the lease was surrendered after the death of one person and another would be granted with the addition of a further "life". (Dibben 1968, 7) Thus leases could continue indefinitely in one family. However, a new lease issued in 1437 for the Trowlesworthy tenement suggests that the 1404 lease, or at least the part relating to Trowlesworthy, had been revoked after only 33 years.

This 1437 lease for the "messuages lands and tenements in Traylesworthy" was issued by John Hulle of Harston presumably the heir of Robert Hulle. (WDRO 710/5) Inheritance by the latter's family is indicated by the reference in the 1404 lease to the holding of the property from Robert Hulle, Ralph Hulle, John Forest and John Jaycoke "and the heirs of Robert himself". (WDRO 710/4) The 1437 agreement was also a "leasehold for lives", granted to John Nicoll, Junior, Joanna his wife and William his son. More detail is supplied about terms and conditions of the lease. The property was defined by the same boundaries as in the early 13th Century. (WDRO 710/1) The Nicolls were required to pay 30 shillings *per annum* to the landowner and four shillings annually to the chief lord, both in four instalments "at the four principal terms of the year". They were obliged to repair and maintain the property at their own expense but were granted as much "housebote and foldbote" from Bickleigh wood as was necessary for maintenance. They were also granted common of pasture on the "wastes" (or moors) belonging to John Hulle. The landowner reserved the right to repossess the property if rent was in arrears one month after any of the terms of payment.

Again the "leasehold for lives" at Trowlesworthy expired sooner than might be expected, after only 27 years, though the cause cannot be ascertained. The Nicolls may have left (or died) shortly before a new lease, in which they are cited as the previous occupants, was issued. (WDRO 710/6) In this lease, dated 1464, John Hulle of Harston grants the "messuages lands and tenements in Traylesworthy" to Walter Schelybeare for a fixed period of 50 years. Unlike a "leasehold for lives", the tenant was not granted the freehold in a "leasehold for years": therefore the latter often included "elaborate clauses about the duties of owner and lessee". (Dibben 1968, 7) However in this case the rent and conditions were the same as in the preceding "leasehold for lives". There is no indication of the length of Schelybeare's tenure or Hulle's ownership as

Trowlesworthy does not re-appear in the documentary record until 1550, by which time it is under new ownership.

16th Century

A turbulent period at Trowlesworthy in the mid-16th Century is attested by a deed of bargain and sale dated 4th January 1550. (Document extract 3) (WDRO 710/7) Property, which had belonged to Nicholas Harrys was confiscated on 9th August 1549 for his part in the Western Rebellion and awarded to George Crokker (and others) for their loyalty during the same crisis. (*ibid.*) The same property was then sold "for a certayne some of money" to John Crokker, presumably a relation. *ibid.*) The forfeited property is not named or described in this deed and Henry Woollcombe doubted that Trowlesworthy was included in the property. (WDRO 710/751) Furthermore another lease, issued in 1545, granted a tenement at "Rogohylle" in Bickleigh to "Nicholas and Alyce Harry". (WDRO 70/154) However, the property is most likely to be, or at least to include, Trowlesworthy; a lease for Trowlesworthy, issued in 1551, by John and Elizabeth Crokker indicates that Trowlesworthy was held, before them, by Nicholas Harrys. (WDRO 710/8) Thus this lease refers to Trowlesworthy "which lands and tenements and other the premises once Nicholas Harrys and Alyce his wife of the said John and Elizabeth forehold". (*ibid.*)

Details of the forfeiture and the impact of the Western Rebellion on the UPV are discussed more fully below. However it may be appropriate here to note that the main business of the 1550 deed was an agreement permitting the widow of Nicholas Harrys to repurchase his property. Thus "John Crokker of Lyneham .. esquier" agreed to sell to "Alice Harrys late the wyef of Nicholas Harrys of Shaue .... Wydowe .... for the some of one hundred marks .... all and singular the said leases bargaynes goods and [?] chattels as late belonged to the said Nicholas". (WDRO 710/7)

However, this transaction seems to have fallen through, as, according to the lease noted above (WDRO 710/8), Trowlesworthy was still in the hands of John Crokker in the following year. This three-life lease was issued in 1551 by John and Elizabeth Crokker to "Wyllyam Wolcomb of Plympton Mary ... yeoman", thereby introducing to

Trowlesworthy the Wolcombe (later Woollcombe) family, whose association with the property continued to the 20th century. The lease required an entry fine of £20 (FN 1), annual rent of 33s. 4d. and yearly chief rent of four shillings. (WDRO 710/8)

The lease was determinable on the lives of Wyllyam, and his sons Baldewyn and Wyllyam. The payment of "his best beast" was required "in the name of an heryott [heriot] or farlyve [farleu]" at the end of Wyllyam Wolcomb Senior's tenancy, that is "after his decease departure or yeldyng up of the premises". (*ibid.*) Finberg distinguishes between a heriot, which was a death duty and a farleu, which was payable at the expiry or premature surrender of a lease, but notes that the terms were mostly used interchangeably in leases. (1952a, 257-8) These payments provided extra capital for landlords, who otherwise in "leases for lives" received only small annual rents after the intial large entry fines.

The Crokkers also granted common of pasture on Leigh Moor and "housebote and foldbote in the wode of bykelegh whensoever nyde [need] shall for sustentacyon of the premises". (WDRO 710/8) Wolcombe was required to "well and suffycyently repayre and mayntenye" "all the houses hedges and dyches" at his own expense.

The Crokkers reserved the right "to re-enter the premises if rent was unpaid for "one quarter of a yere aft[er] any feast of the feasts aforesaid", and agreed to warrant and defend the lessee's right to the property "agaynst the Chief lord ... as agaynst all other persons". (*ibid.*)

Finally the Crokkers appointed attorneys John ?Bowe and Nycholas Wydelake, to deliver seizin to Wyllyam Wolcombe. "Delivery of seizin was appropriate in a leasehold for lives, as these, in the absence of a specified end of the lease, conferred freehold tenure. (Dibben 1968, 6) This gave particularly strong title to the lessee; a seized lessee "had very great advantages, not only as against third persons but even as against others entitled to the land." (Holdsworth 1927, 60) This may explain the developments outlined in the next three title deeds, which were issued within one month at the end of the decade. (WDRO 710/9 - 11)

FN 1 listed as £30 in WDRO Accession 710 Register

In the first of these, dated 9th March 1559/60 Trowlesworthy is purchased by John Crokker of Lyneham from John Hele of Holbeley, Yeoman. (WDRO 710/9) There is no indication of when and how John Crokker lost Trowlesworthy between 1551 and 1559/60, of when or how John Hele acquired it, or why John Crokker bought it back in 1559/60 only to sell it again within a month to his original tenant, William Wolcombe. (Document extract 4) (WDRO 710/11) The third deed in this series dated 29th March, records the sale by "John Crokker of Lynham ... senior esquire" to "William Wolcomb of Plympton Mary ... yeoman" and states simply that Trowlesworthy was "lately in the tenure of the aforesaid William Wolcombe or his assigns which all and singular premisses with their appurtenances forever purchased for me and my heirs from the late John Hele." (*ibid.*) (FN1)

A possible explanation is that Crokker effectively lost his rights to the property after delivering seizin in 1551 to the lessee, Wolcombe. In order to finally sell the property to Wolcombe, Crokker may have been required to establish his rights to it by repurchasing it, possibly in a fictitious transaction, with John Hele acting as an intermediary. Alternatively, John Hele may have been one of the associates who, with George Crokker, were granted Trowlesworthy in 1549. (WDRO 710/7) Hele might have challenged John Crokker's right to the property and had to be bought out before Crokker could sell Trowlesworthy to William Wolcombe. Perhaps more plausible is a third alternative that the three deeds represent an early form of mortgage. (Roger Mercer pers. comm.) Mortgages proper did not appear until *c.* 1600. However, by this arrangement, Crokker may have raised a loan from Hele with Trowlesworthy as security, but then reclaimed the property prior to selling it to Wolcombe, who had been tenant since 1551.

Both conveyances grant to the purchaser for 100 marks "all those messuages lands tenements meadows pastures and grazings woods underwoods rents reversions and services and all other hereditaments with those appurtenances called Traylleswortby". (WDRO 710/9, 710/11)

FN1 Both these conveyances are listed in WDRO Accession 710 Register as the "bargain and sale" type of title deed. However the diagnostic phrase "granted, alienated bargained and sold", is absent, while the seizin ceremony is more indicative of the earlier Medieval "gift". Dibben suggests that such deeds, incorporating elements of the bargain and sale and the gift evolved in the late 16th/early 17th centuries, and might be alternatively called feoffment. (1968, 10-11)

The other deed in the series is a letter of attorney, dated 25th March, pertaining to the transaction between Hele and Crokker. (WDRO 710/10). John Crokker appoints Vincent Calmady of Plympton Mary, gentleman to receive seizin for Trowlesworthy from Thomas Crokker and Robert Wolcombe, the attorneys of John Hele.

In his 1842 summary of the family archives, Henry Woollcombe concluded that William Wolcombe must have bequeathed Trowlesworthy to one of his sons, Baldwyn, while leaving his principal estate, Holland and another property, Pitton to his other sons Robert and Willyam respectively. (WDRO 710/751) In William's will of 1570/71 Baldwyn also received 100 sheep, ten cows, and two mare colts, "all at Troulsworthy". (*ibid.*) This gives some idea of the scale of farming at Trowlesworthy in the later 16th century. Baldwyn then seems to have died without issue, and Trowlesworthy reverted to the elder branch of the family.

The two subsequent deeds strengthened the claim to Trowlesworthy of this elder branch. Thus in 1584 Emme Wolcombe, the widow of Robert Wolcombe (the son and heir of William Wolcombe), quitclaims or relinquishes her interest in properties in Shaugh and Plympton St Mary in favour of her son, John. (WDRO 710/12) A widow automatically enjoyed a dower right of life interest in one-third of her late husband's property. (Holdsworth 1927, 87) In the following year William Wolcombe of Pitton in Yealmpton, yeoman quitclaims his interest in property of his father Robert, in Trolsworthie in favour of his brother John Wolcomb of Holland, yeoman. (WDRO 710/13) Emme's quitclaim indicates that Trowlesworthy is simply one part of a collection of properties owned by the Wolcombe family in the parishes of Shaugh and Plympton St Mary. It perhaps illustrates the growing importance of a family which had reached gentry status by 1590. (WDRO 710/14)

The landowner in the next lease is described as "John Wolcombe alias Bawden of Hollande ... gentleman". (WDRO 710/14) Evidently an important man, his influence in the tin industry is noted below. (see below p. 367) On 10th February 1589/90, he leased Trowlesworthy to "William Strode of Newingham ...esquier" (also connected in the mining industry) for 99 years or the lives of Strode and his children, Richard, Mary and Elizabeth. Inclusion of a fixed term of 99 years in a leasehold for lives, removed freehold status for the tenant and therefore supported the landowner's title. (Dibben 1968, 7) The property was let for an entry fine of £330 and an annual rent of 57sh. 4d. in four equal instalments. Six months grace was allowed before repossession. "An heriott or farlyve" of 26sh. 8d. was required after the deaths of Richard, Mary and Elizabeth but not after the deaths of Elizabeth and/or Mary while Richard was still alive.

The lease also granted "comon of pasture, turbary furse and heath in and upon Leigh More" and "Comon of Eastoners" [Estover] as well as "housboote and foldeboote in Bicklye Woode". The Strodes were, as usual, required to maintain the tenement and the houses, hedges and ditches.

It is not known when the Strodes' lease expired but in the next lease, issued in 1651, Trowlesworthy was occupied by John Meade and had become a rabbit warren. (WDRO 710/15) Thus archaeological remains of warrening: pillow mounds, vermin traps and possibly the boundary bank, **Mon X4**, must have been constructed after the early 17th century.

Subsequent history belongs to a later chapter. However, it may be appropriate here to make some general comments about the series of deeds for Trowlesworthy. It is clear that no additions of land were made to Trowlesworthy during this time. Thus the same boundaries are cited in 1437, 1464, 1551, 1589/90 and 1651 as in the late 12th century. (WDRO 710/5, 6, 8, 14, 15, 1) An attempt to assess the changing value of the property has not proved possible because of the difficulty of correlating payments made under socage tenure, considerations in conveyances and entry fines and rents in leaseholds for lives or leaseholds for years. In any case, the sums of money in conveyances were often fictitious. (Dibben 1968, 18)

3.3.4 Buckland Abbey.

It has already been noted that the N bank of UPV lay probably within the manor of Bickleigh, but certainly within the combined manors of Bickleigh, Buckland and Walkhampton, which were granted to Buckland Abbey in the late 13th century. The Abbey boundary may now be considered in detail. (see fig 3:18) For UPV, the relevant extract of Amicia's and Isabella's charters concerns the E. and SE. boundary:

and by Hysfochres, and by Siwards Cross and Gyllesburgh and Plymcrundla to the Plym, and thence by the Plym towards the west to Yaddabrook, and so by the bounds which surround Rydemore and Smalacumba, that is to say, by the old ditch to the angle of the ditch of Yllalonde, and thence by Hurtwallen to Smalacumbacrosse and Smalacumbalak...
(translated in Brooking Rowe 1875, 355,357)

The E. boundary, which borders the Forest of Dartmoor is outlined in successive perambulations of the forest boundary. Thus the boundary from Mistor [Mis Tor] to Hysfochres [North and South Hessary Tors] to Siward's [or Nun's] Cross, to Gyllsburgh [Eylesbarrow] and to the River Plym was documented from at least 1240. (Somers Cocks 1970, 280) The boundary marker at Eylesbarrow was probably Eylesbarrow Cairn, **Mon 1162.** This is the southern of two cairns on the summit of Eylesbarrow Hill. A reave, **Mon 271,** abuts the N. cairn, **Mon 1163,** but the S. cairn, at which the present boundaries of Walkhampton, Lydford and Sheepstor parishes converge, seem to be the post-prehistoric boundary marker.

Plymcrundla is less-easily identifiable. Burnard and Prowse (1893, 499) suggest that this may denote the prehistoric enclosure, **Mon 1087,** N. of the R. Plym at Plym Steps. Gover, Mawer and Stenton (1931, 239) support identification with Plym Steps, deriving Plymcrundla from "the original sense" of *crundel* of "curved valley". However, Somers Cocks (1970, 280) prefers the tinworks on the R. Plym at Crane Lake, S. of Plym Ford, as "*crundel* seems to have a quarrying significance in place-names." The latter may be more likely, as a line from Eylesbarrow to the foot of Crane Lake agrees with the 1240 forest perambulation and the present boundary of Lydford parish, though a 1608 forest perambulation veered out to Plym Head. *(ibid.)*

West of Crane Lake, the Buckland boundary encloses the whole of the N. bank of the R. Plym as far as Yaddabrook. The latter is presumed to be Legis Lake. (Burnard and Prowse 1893, 509; Crossing 1912, 448) Corroborative evidence may be found in the bounds of tinworks, dated 1589 and 1625, which refer to Legis Lake as Fadabrowke and Eadabroake respectively. (WDRO 72/990/66; 72/1034) (see App. D).

The route of the boundary, West of Yaddabrook/Legis Lake is of particular interest and has several implications. This follows "the bounds which surround Rydemore [Ringmoor] and Smalacumba [Smallacombe], that is to say, by the old ditch to the angle of the ditch of Yllalonde [?], and thence by Hurtwallen [?] to Smalacumbacrosse [?] and Smalacumbalak [?Smallacombe Brook]".

The most likely interpretation must be along Legis Lake to, and then along, the wall which marks the interface between the open pasture on Ringmoor Down and the enclosed fields N. of Brisworthy because this coincides with the present Parish boundary. As noted above parish boundaries often follow manorial boundaries and, further W, the Abbey boundary closely follows the present Meavy parish boundary. (see Fig. 3:18 and Document Extract 5)

Thus the present Meavy parish boundary around Ringmoor Down, which, like many parish boundaries may have been established by the early 13th century (Hoskins 1952b, 302) may follow an earlier boundary between Bickleigh Manor and an early manor of Meavy, later subdivided into the five Meavy holdings, recorded in Domesday Book. (Thorn,ed. 1985, 17,79-82; 29,9) The corn-ditch, presently defining the moorland edge and the limit of UPV, may be a later renovation along the same route, or it may even be the original 13th Century "old ditch".

W. of what is now Brisworthy plantation the boundary is less clear. Smalacumbacrosse was once identified with Marchant's Cross (Crossing 1892, 64; Gover *et al* 1931, 231) so that the Abbey boundary would have veered westwards away from the parish boundary. This may be supported by the continuation of the corn-ditch, which defines the S side of Ringmoor Down, westwards along the S side of Lynch Common to Marchant's Cross. Early use of the latter site as a boundary marker is also indicated in a charter, dating to 1031, for an estate in Meavy. (Finberg 1960, 30) Here, stepping stones where "an important medieval road" crossed the R. Meavy near Marchant's Cross, marked one part of the boundary. (*ibid.*)

However, corn-ditches primarily define the open moorland / enclosed field interface and need not necessarily coincide with an estate boundary. Of greater significance may be the parish boundary, which proceeds along the W side of Ringmoor Down to Ringmoor Cottage and W along Smallacombe Brook to the R. Meavy. It is possible that the Abbey boundary (and former Bickleigh manor boundary) follows the parish boundary, and Worth (1942b, 203) suggests that Smalacumbacrosse was situated near the head of Smallacombe Brook, nearly one mile to the E of Marchant's Cross. "The angle of the ditch of Yllalonde" could be the SW corner of what is now Brisworthy Plantation and "Hurtwallen" (FN 1) may refer to the boundary wall, defining the W boundary of Ringmoor Down.

Burnard and Prowse suggest that "Hurtwallen" may be "Hurstwallen" derived from *Hyrst* meaning thicket or brake. (1893, 495) They equate this with a thicket near Marchant's Cross. (*ibid.*) Alternatively, it is possible that the combination of "thicket" and "wall" refers to a boundary bank with a hedge on top. Thus the wall-bank, now dilapidated and topped with hawthorn and gorse, marking the western boundary of UPV fits this description. These are usually relatively late in date but, as Fleming and Ralph point out, can derive from the maintenance of an older hedge-bank. (1982, 104) The contrast between this boundary and the only other wall-bank in UPV (between fields Mons 880f and 880g/h at Ditsworthy) is striking and suggests that this Ringmoor Down boundary is of some antiquity.

As noted above (see p.176) Sheepstor village lies outside the manors of Buckland, Walkhampton and Bickleigh, though "the lands and villeins of Tor at Shitestor" are listed separately in the foundation deeds. (Brooking Rowe 1875, 355,358) The boundary runs close to the N. side of Ringmoor Down, though all the UPV area lies within. From an unidentified point on the River Meavy, known as "Olyak" [possibly near Yeo (Burnard and Prowse 1893, 499)] the boundary crosses the Plympton-to-Sheepstor road, which is possibly that known as Portland Lane, (OS Map 1:25,000) and runs eastwards to "Biricombaford". The latter seems to be a ford across Sheepstor Brook, near Burcombe Gate, which according to Hemery (1983, 169), is the gate at the SE corner of the enclosed fields around Nattor and Yellowmead. The nearby ford, at SX 5790 6732, within UPV, may be of sufficient antiquity to be a 13th Century landmark, as at this point, the Sheepstor-Eylesbarrow track follows the route of Jobbers Path,

FN 1 Other Devon place names, such as Wallen Barton in Stockleigh Pomeroy parish, and, on Dartmoor, Wallon in Drewsteighton parish and Wallandhill in Throwleigh parish, all with origins at least as early as the 13th and 14th centuries, derive from the OE *weall* for wall. (Gover *et al* 1932, 418,434,454).

Mon 1085, an old track associated with the wool trade. (*op. cit.* 169-170; 55-6) Another possibility is a ford, recorded by Hemery outside UPV, where Sheepstor Brook is crossed by an overgrown branch of Jobbers Path, which runs through Burcombe Gate. (Hemery 1983, 170) It is possible that the boundary up to the ford from Portland Lane followed the corn-ditch presently marking the limit of enclosed fields (and the limit of UPV survey), but this is far from certain.

Thus a detailed examination of the boundary demonstrates that UPV, N. of the Plym and up to the Eylesbarrow-Plym Ford line belonged to Buckland Abbey from 1278 until the Dissolution. The implications for the history of farming in UPV will be discussed below but it may be appropriate at this stage to note the antiquity of the boundary on the S side of Ringmoor Down, W of Legis Lake. Even in the 1280's it was described as an "old ditch". The wall-bank, marking the W side of Ringmoor Down may be contemporary or may be a later construction, marking a pre-existing boundary. Furthermore, if the limit of enclosed fields on northern Ringmoor Down have not encroached further onto moorland since the 13th century, then the interface, presently marked by a corn-ditch, may also be the original Buckland Abbey boundary. However the corn-ditch would then post-date 1291, at which time the Buckland estate was defined here by boundary stones.

a) Ringmoor and Gutter Tor.

Unfortunately no records concerning the administration of the N bank of the R. Plym, during the earliest period of Buckland Abbey's ownership have been found so that detailed information is not available until the 15th century. Thus in a 1404 lease, John Bykewill, Abbot of Buckland grants a tenement in Smalecomb [Smallacombe] to Martha Vere and her daughter Joan for an annual rent of 5sh. 1d. (VDRO 70/247) (FN 1). Of particular interest to UPV is the grant of:

> "Common of pasture upon all our waste of Rydmoredon [Ringmoor Down] as far as Eyllesburgh [Eylesbarrow] and, in the same place, upon all our empty land of Rudemor [Ringmoor] and Guttorr [Gutter Tor] which the tenants [who] rented that land have surrendered [it]". (*ibid.*)FN 2

FN 1 "Smalecomb" probably corresponds to the structure recorded by Price (1980, 87) at SX 554667 near Smallacombe Brook.
FN 2 *"com[m]unia[m] pastur[ae] sup[er] totu[m] vastu[m] n[ost]r[u]m de Rydemoredon usque eyllesburgh & sup[er] tota[m] t[er]ra[m] n[ost]ra[m] vasta[m] ib[de]m de Rudemor & Guttorr don[ec] tenentes cepunt illa[m] terra[m] ad reddit[] "*

The pasture was granted "for as many cattle as are able to be wintered in good health". (*ibid.*).

It is important to note that this document clearly distinguishes between the large area of Ringmoor Down, over which rights of common were granted, and specific parts of it, which were rented out individually. The earlier references to Ringmoor Down, in Amicia's and Isabella's charters, relate to the common grazing area and are not necessarily identified with any of the extant farmsteads. However, this deed clearly refers to lands, presumably tenements, called Rudemor and Guttorr situated on Ringmoor Down. The former may correspond to one of the three farmsteads around Legis Lake, **Mons 315, 325 and 344**, and Guttorr must be **Mon 677** on Gutter Tor. Gutter Tor was certainly occupied by 1317; in that year, Ralph de Gotetorre was one of 33 men, who, with Thomas the Abbot of Buckland and six monks, trespassed in the Chase of Dartmoor and "hunted therein without licence." (Cal. Pat. Rolls, Ed III,18) Gover, Mawer and Stenton (1931, 240) record an earlier reference in 1281 in unpublished (and unidentified) Assize Rolls.

However, of greater significance is the evidence in this lease that these tenements had been abandoned by 1404. This will be discussed more fully below but it is important to note at this stage, firstly, that these settlements must have been occupied at least by the early 14th century, if they were vacated by 1404 and, secondly, that the fields below Gutter Tor, enclosed in Phase II of Ditsworthy Farm, must post-date this abandonment of Gutter Tor farmstead.

b) <u>Ditsworthy</u>

In the 1404 lease the name, "Ringmoor Down", is applied to the whole of the N. bank of UPV as far as Eylesbarrow. Rudemor and Guttorr are noted in the lease because they are unoccupied and therefore included in the common pasture. However contemporary occupied tenements in this area would have been outside the common pasture and therefore not necessarily specified. Thus, although, no references for Ditsworthy appear until the second half of the 15th century, it does not follow that it was not in existence in 1404.

The earliest documentary appearance of "Ditsworthy", found by Gover, Mawer and Stenton, was in the form of "Derkysworthy" in unpublished court rolls of 1474 and 1481. (1931, 239) The suffix "worthy", as in the earlier example of Trowlesworthy, suggests that these references are associated with a farmstead, rather than a feature or geographical area, though of course not necessarily with the earliest occupation of the site. These references may relate to the tenure of William Pomeray, who according to a 1493 lease, held Ditsworthy before that date. (WDRO 70/183)

The lease for Derkysworthy, granted in 1493 by Thomas Olyver, Abbot of Buckland provides more detail on the management of Buckland Abbey's UPV possessions. (WDRO 70/183) The tenement was leased for 70 years to Thomas Poell, Joan, his wife and John, his son, for an annual rent of 13s. 4d. in four equal instalments. The lessees also had to pay 2d. annually, probably as a chief rent, though the payment had to be made to the abbot and his successors. In addition, a "best beast" was to be given as a heriot after the death of a tenant. The rights granted to the lessees and services demanded by the lessor, also included in the deed, are standard in contemporary leases. Thus the Poells were granted timber for the repair of houses as well as "common of pasture upon all our wastes at Rynnemore Down for so many cattle as are able to be wintered upon the aforesaid tenement". In return, they were required to maintain the houses and enclosures on the property and to repair the Abbey's weirs and fisheries at Bickleigh when requested. Finally they were expected to attend the court at Horrabridge, twice a year, at the feast of the Invention of the Holy Cross (3rd May) and at Michaelmas (29th September).

Subsequently Ditsworthy does not reappear specifically in the documentary record until after the Dissolution. However, it probably appears invisibly in the form of rent payable immediately after the surrender of Buckland Abbey to the King. (FN 1) Thus the Ministers accounts, from Michaelmas 1540 (31 Henry VIII) to Michaelmas 1541 (32 Henry VIII), transcribed by Brooking Rowe (1876, 800-807) list the Abbey's former possessions and its income from rentals.

FN 1 Abbot Toker surrendered Buckland Abbey on February 28th, 1539. (Gill 1968, 40)

Buckland Abbey had already been leased to George Pollard but most of the property was being administered by bailiffs on behalf of the crown. (Brooking Rowe 1876, 801) The Accounts of Walter Langesforde, bailiff, include a separate entry for "Shittistor and Rynmore", in which the bailiff "is answerable ... for 62sh. 11d. for all the fixed rents of tenants". (*op. cit.* 803)

In the record of the sale of Abbey property to John Slanning in 1546, the same annual rent is payable for Sheepstor and Ringmoor but it is divided into 52sh. 11d. for "a messuage at Shittestor" and 10sh. for "land at Rynmore". (Youings 1955, 93) It is possible that the messuage in Sheepstor corresponds to Ditsworthy; little of Sheepstor lies within the Abbey boundary, while Ditsworthy is referred to in the 1493 lease as "Derkysworthy ... in Shyttystor". (WDRO 70/183) However, it should be noted that Buckland Abbey had also been granted "the lands and villeins of Tor at Shitestorr", presumably corresponding to Torr fields at SX 563 678. (Brooking Rowe 1875, 358) These lands "with the appurtenances and with their villanages and chattels and belongings" (*ibid.*), seemingly a more substantial property, may be more worthy of the 52sh. 11d. rent than Ditsworthy, which only paid 13s. 4d. in 1493 and 1552 (WDRO 70/183; 70/156) and 20sh. in 1670. (WDRO 70/189) However, the remaining 10s. for "land at Rynmore" seems a small sum to account for the income from Ditsworthy and the rest of Ringmoor Down. Grazing rights on Ringmoor Down, appurtenant to a tenement elsewhere, might not necessarily be included in the rental for "Rynmore"; the cost would probably be accounted for in the rent of the relevant tenement. Therefore, Ditsworthy may have been solely responsible for the rent of 10sh., though this figure still seems rather low.

The N bank of UPV was included in the property sold to John Slanning in 1546. In 1552, the tenement of "Dorkysworthy" was leased by John Slanning to Elie Shullibeare, his wife Joan and son John. (WDRO 70/156) The lease was issued for a term of 70 years or three lives, for an annual rent of 13s 4d and a chief rent of 2d. The privileges granted to the tenant and services owing to the landlord were similar to those included in the previous lease for Ditsworthy in 1493. Shullibeare was granted common of pasture on "all my lands of Rydmore Downe" and timber for the repair of the house. In return, he owed suit of court and millsuit and undertook to repair weirs and fisheries when requested.

Ditsworthy does not reappear in the documentary record until over a century later, by which time it has become a warren. The subsequent documentary history of Ditsworthy will be discussed below in chapter 4. It remains to note that no documentary references have been found for Whittenknowles or the other two of the three farmsteads around Legis Lake. These may well exist in the documentary record but under unknown names.

3.4 THE DEVELOPMENT OF SETTLEMENT IN UPV IN THE LIGHT OF ARCHAEOLOGICAL AND DOCUMENTARY EVIDENCE

3.4.1 Evidence for Continuity of Settlement: Iron Age to the Dark Ages.

It was once thought that the predominance of English over Celtic place-names in the whole of Devon, including Dartmoor, demonstrated that Saxon settlers occupied a previously sparsely-populated land, possibly largely abandoned after emigration to Brittany. (Gover *et al* 1931, xix-xx)

The relict Celtic community was represented by names, such as Walla Brook on the R. Dart, meaning "Welsh" or "foreigner". (Gover *et al* 1931, 16; Somers Cocks 1970b, 78) However, place-name evidence has limitations; for example, a place-name known in the 20th century may not necessarily be in its original form, and it is perhaps likely that:

> "Celtic farmsteads, whose owners had remained undisturbed through the Saxon occupation ... gradually acquired an English name from the people, who lived in the central village of the territory." (Hoskins 1954, 49)

Considering the extensive reuse of prehistoric enclosures and walls in UPV, and the location of Whittenknowles and Willings Walls Medieval settlements actually within prehistoric enclosures, it tempting to see some continuity in UPV. However, if considerable Celtic continuity is proposed for Devon as a whole, survival on Dartmoor may still have been limited. Until more sites have been excavated, it is not possible to establish criteria, by which Celtic sites may be identified in the field. However, distribution of Iron Age settlements indicates a withdrawal to the moorland edge. (Simmons 1964, 198) Within Devon as a whole, Ravenhill (1969, 152-3) demonstrates that the Celtic population was less concentrated in the uplands than previously believed. Thus 60% of sites with Celtic associations are found below an altitude of 450ft OD, and 83% are below 600ft OD. This was probably necessitated by the onset of wetter conditions at *c.* 500 BC, which encouraged the spread of sphagnum peat. (Simmons 1964, 198) Deforestation in the Late Bronze Age may have accelerated bog formation by encouraging podzolisation of the soil. (Gilbertson and Collis 1982, 565)

However, while UPV probably had no permanently occupied settlements after this period, environmental evidence suggests that the valley may still have been used for grazing, presumably for livestock from lower-lying farms. The upper levels of pollen samples taken from Blacka Brook, Lee Moor (SE of Saddlesborough summit) and Wotter Common show a slight reduction in the pollen of grassland weeds and the stability or slight increase in the pollen of trees and *Calluna*, suggesting that, after the Bronze Age, some regeneration of woodland and heath had encroached on pasture. (Beckett 1981, 262) However, variations between these pollen samples may suggest different local developments. Thus, Beckett suggests that farming decreased markedly in exposed locations, such as the Lee Moor pollen site, SE of Saddlesborough, while some pastoral farming continued, though on a reduced scale, in sheltered valleys, such as the R. Plym and Blacka Brook. (Beckett 1981, 264-5)

3.4.2 Saxon and Early Norman Settlement.

a) The possibility of permanent settlement in the Upper Plym Valley

The chronology of the Saxon Conquest of Devon, constructed from fragments of documentary evidence, has long been a subject for discussion. However, it appears that the Saxons first moved into Devon in the mid-7th Century, that N. Devon was occupied by 682 (FN 1) and that the whole county was conquered by between 710 and 722 ((FN 2).

FN 1. Hoskins suggests that the documented flight of the Britons to the sea in 682 represents the arrival of Centwine at the Atlantic coast. (1952b, 299). A monastery had already been founded at Exeter by 680 which suggests "secure Saxon occupation well to the W. and N. of the city". (*ibid.*)
FN 2 In 710, Ine and Nunna defeated Geraint of Dumnonia near the R. Tamar and in 722, Ine's men were fighting in the far W. of Cornwall. (Anglo-Saxon Chronicle 1954 ed., 42; Stenton 1945, 72)

(Somers Cocks 1970b, 76; Hoskins 1952b, 299; 1954, 41-45; Stenton 1945, 72)

None of the UPV settlements can be positively attributed to the Saxon period from surface remains. However, the possibility remains that part of UPV is contained in some form within Domesday Book, which, although compiled after the Norman Conquest, essentially describes Saxon land use, or "Old English society under new management." (Thorn ed. 1985, pt 1, 2) The probability that N UPV lay within the manor of Bickleigh was outlined above. (see fig 3:18) Therefore, although N UPV is not listed by name in Domesday Book, it may still be included anonymously in the entry for Bickleigh.

It is clear that Domesday Book does not describe the complete settlement pattern. It was acknowledged by Darby and Welldon Finn (1967, 228) and by Morgan (1940, 307) that their respective totals of 983 and 1170 separate places identified in Devonshire Domesday were far below the total number of individual settlements. Most important is the recognition that in Domesday Book, large areas, containing many individual settlements could be encompassed in a single entry under one title. Thus, Morgan (1940, 307) and Hoskins (1952b, 312) recognised that the apparently blank cordons around the larger manors on a distribution map of Domesday place-names did not truly reflect the settlement pattern and:

> "we can be pretty certain that a great number of small settlements which existed in 1086 escaped specific notice in Domesday because they were silently included within some parent manor" (Hoskins 1952b, 311)

Of particular interest to UPV is Hoskin's suggestion that, in the Devon landscape of few nucleated villages, but numerous hamlets and even more isolated farmsteads, each *villanus* pertaining to a manor could represent one farmstead. (Hoskins 1963, 33) If so, the total number of 8,508 *villani* (Burnard 1907, 202-3), in addition to the approximately 1000 demesne farms would account for *c.* 9500 farmsteads in Domesday Devon. (Hoskins 1963, 21) As Hoskins points out, a certain proportion of the *villani* must have lived in villages (*ibid.*); yet while this figure must be viewed as a maximum, it is likely that the number of individual settlements in 1086 is much greater than might at first appear and that "the pattern of settlement in 1086 was virtually what it is today." (Hoskins 1963, 45)

Villein farms have been successfully identified by Hoskins in low-lying parts of North and mid-Devon. (Hoskins 1963, 25-43) The possibility that one or more of the UPV farms were occupied by Domesday *villani* must therefore be considered.

Identification of villein farms in Bickleigh manor is a subject for further detailed research. However some deductions can be made from the OS Map. Hoskins (1963, 25) suggests that the demesne farm can be identified by its position near the church or village, and by names such as "barton". Thus Hele farm, next to the church and present village of Bickleigh, was, in 1697, a 250 acre farm called Heale Barton (WDRO 70/122) and, in 1546, was referred to as "the chief messuage of Bickeleigh". (Youings 1955, 92) Its size also suggests it is the demesne farm, which in Domesday, paid tax for 1 virgate, that is, one-quarter of the total property. (Thorn ed. 1985, 21,19) The neighbouring Combe Barton may have been part of it. This still leaves Upperton, Woolwell and Collard, the names of which are recorded in the 13th century, Ham and Faunstone recorded in the 14th century, and Darklake recorded in the 15th century (Gover *et al* 1931, 224,258-9) as well as Hatshill Farm, Leigh, Combepark, Leighbeer, Whittaburrow, Hartstone and Boghill. (OS Map 1:25,000) This suggests that there are enough farms in Bickleigh proper to account for the seven *villani*, without recourse to northern UPV.

It may also be significant that there are no place-names of Anglo-Saxon origin in UPV, though clearly, if there were up to 9500 farms in 1086, their original names have not survived. Alexander identified only 3000 names in Devon of Anglo-Saxon origin. (Alexander 1932, 94) However, while the suffix *worpig* [worthy] is of Saxon origin, its use continued well after the Norman Conquest. Therefore, derivation of Trowlesworthy and Ditsworthy depends on their prefixes and both are thought to be personal names (Travell and Durke) of ME origin, that is, after 1150. (Gover *et al* 1931, 259,239) This contrasts with the neighbouring Cadworthy and Brisworthy farms, which are derived from OE personal names, that is "Cada's" worthy and "Beorhtwine's" worthy. (Gover *et al*

1931, 229) These may be interpreted as villein farms of Goodameavy. (Thorn ed. 1985, 17,80)

Furthermore, it is more likely that the distribution of villein farms will reflect the distribution of manors named in Domesday Book. The latter reveals some occupation of the moorland fringe, but with a preponderance in eastern Dartmoor rather than on the wetter western slopes. (Linehan 1966, 117; Darby and Welldon Finn 1967, 234) In Darby and Welldon Finn's population map, the lowest density in the whole of Devon, apart from the Forest of Dartmoor, occurs in the area SW of the forest. (1967, 248)

Therefore, in the absence of excavation it is not possible to ascribe the extant settlements to the Saxon or early Norman periods.

b) The probable use of the Upper Plym Valley for pasture

If permanent settlement in northern UPV was not established by 1086, it still does not follow that the land was unused. If UPV is contained within the Domesday Book entry for Bickleigh, it is most likely to be found in the description of pasture: "1 league long and 4 furlongs wide". (Thorn ed. 1985, 21,19) The accuracy of Domesday Book dimensions is notoriously difficult to assess. Darby and Welldon Finn (1967, 265) suggest that some of the larger figures may represent the sum of separate areas of pasture. Furthermore, it is far from certain how the Norman acre, league and furlong relate to modern measurements. *(op.cit.* 264) However, if one league corresponds to 1½ miles, as suggested by Somers Cocks (1970, 87), then Ringmoor Down may have constituted the total pasture for Bickleigh Manor. Thus, Ringmoor Down covers an area of 1.4 miles (2.3 km) from Ringmoor Cottage to Gutter Mire, by 6.22 furlongs (1.25 km) at the narrowest point between the Sheepstor - Eylesbarrow road and the R. Plym.

Although this area is slightly wider than that in the Domesday Book entry, and although it does not account for the large portion of Sheepstor parish, E. of Gutter Mire, the similarity is striking. It may be assumed that Domesday Book entries were approximations, and there is no obvious alternative location in Bickleigh, which would accommodate the pasture. Furthermore, the area E. of Gutter Mire, may have been considered as rough moorland rather than pasture, and therefore not sufficiently remunerative to be recorded in Domesday Book. Today, the predominant heather cover E. of Gutter Mire, contrasts with the grassland on Ringmoor Down.

Some antiquity is implied for the clearance of Ringmoor Down, presumably for pasture. The derivation of the name Ringmoor or "Rydemore" from ME *ridde* meaning "land cleared of wood or undergrowth" suggests that it had been cleared at least by the first record of the name in 1278, in the Buckland charters. (Gover *et al* 1931, 239, 283; Brooking Rowe 1875, 355)

However, although Ringmoor Down contains many boundaries, which define areas of pasture or facilitate stock control, none of these can be attributed to the Saxon period. The overall plan suggests that the layout of these boundaries was determined by pre-existing farmsteads. For example, boundaries, **Mons** 276a - e, and therefore the drove-way **Mon** 277, were built around Legis Lake and probably Ringmoor Down farmsteads. (Sheet 14) Furthermore, boundary, **Mon** 340, is aligned with Ringmoor Down farmstead, while boundaries, **Mons** 326, 331 and probably 337 and 335 run up to Legis Tor farmstead. (Sheet 14) Therefore they cannot pre-date the period of permanently-occupied settlement.

However, some archaeological evidence may still relate to Domesday Book. It was noted above that both Lovaton and Brisworthy were probably Domesday holdings; therefore a late 11th century date may be attributed to the boundary between them and Bickleigh manor, including the boundary S of Ringmoor Down, which presently marks the interface between the open moorland and the enclosed fields, and, which in 1278 was described as an "old ditch". (Brooking Rowe 1875, 355) (see above p.194) The contemporary drove-way leading through the corn-ditch onto the SW part of Ringmoor Down, now covered by Brisworthy Plantation would have provided access onto the pasture. The boundary, which defines the W side of Ringmoor Down may have an equally early origin, if the manor did indeed follow the parish boundary, as suggested above.

Furthermore, it may also be suggested that the use of Ringmoor Down as pasture for Bickleigh manor may partly explain anomalies in the

Domesday livestock figures. In a study of the regional distribution of dominical livestock (FN 1), Morgan found surprisingly low densities of sheep and cattle in the moorland regions, where one would expect to find the greatest amount of grazing land. (Fig. 3.19) (1940, 322-5) Thus, out of the eleven regions of Devon (omitting the Forest of Dartmoor), the Dartmoor Border region, "corresponding very closely to the 21 moorland parishes", had the lowest density of sheep (11 per 1000 acres compared to, for example, 42.2 per 1000 acres in N Devon and 58.8 in the Torbay region) and the lowest density of cattle (1.8 per 1000 acres compared to 5.6 in Mid-Devon and 7.2 in NW Devon). (Morgan 1940, 310,322) The figures for individual manors on the Dartmoor border are also relatively low. Thus 70 sheep were recorded on the demesne farm of a manor in South Brent (Thorn ed. 1985, 6,12), but most had less than forty sheep and many, for example, Gidleigh manor in Gidleigh parish, Beetor in North Bovey parish, Natsworthy, Blackslade and Dewdon in Widecombe-in-the-Moor parish and Cornwood in Cornwood parish had none at all. (*op. cit.* 15,7; 16,60; 30,2; 34,46; 20,10; 15,36) This compares with figures of, for example, 560 at Berry Pomeroy and 500 each at Tawstock and Shebbear. (Darby and Welldon Finn 1967, 288)

Morgan concluded that "the dominical animal populations bore no simple relation to the facts of soil and climate and were bound up with variations of agricultural practice" and, indeed, the proximity of the Forest of Dartmoor may have entailed certain restrictions on the border region. (Morgan 1940, 322) However, the Domesday evidence for UPV suggests that livestock from outside the Dartmoor border parishes also used the moorland region. Thus, if northern UPV was included in the pasture for Bickleigh manor, it may also have partly accounted for the 146 sheep on the demesne farm, which would otherwise be included in the total for the SW Devon region. The distribution of dominical livestock may not, of course, necessarily reflect the pattern for the total number of animals. However, it may still be suggested that the moorland was more heavily used for grazing than is apparent in a simple calculation of livestock distribution according to the demesne farms, and the practice postulated for the N bank of UPV may have been repeated elsewhere.

FN 1 Domesday Book lists livestock only on demesne farms.

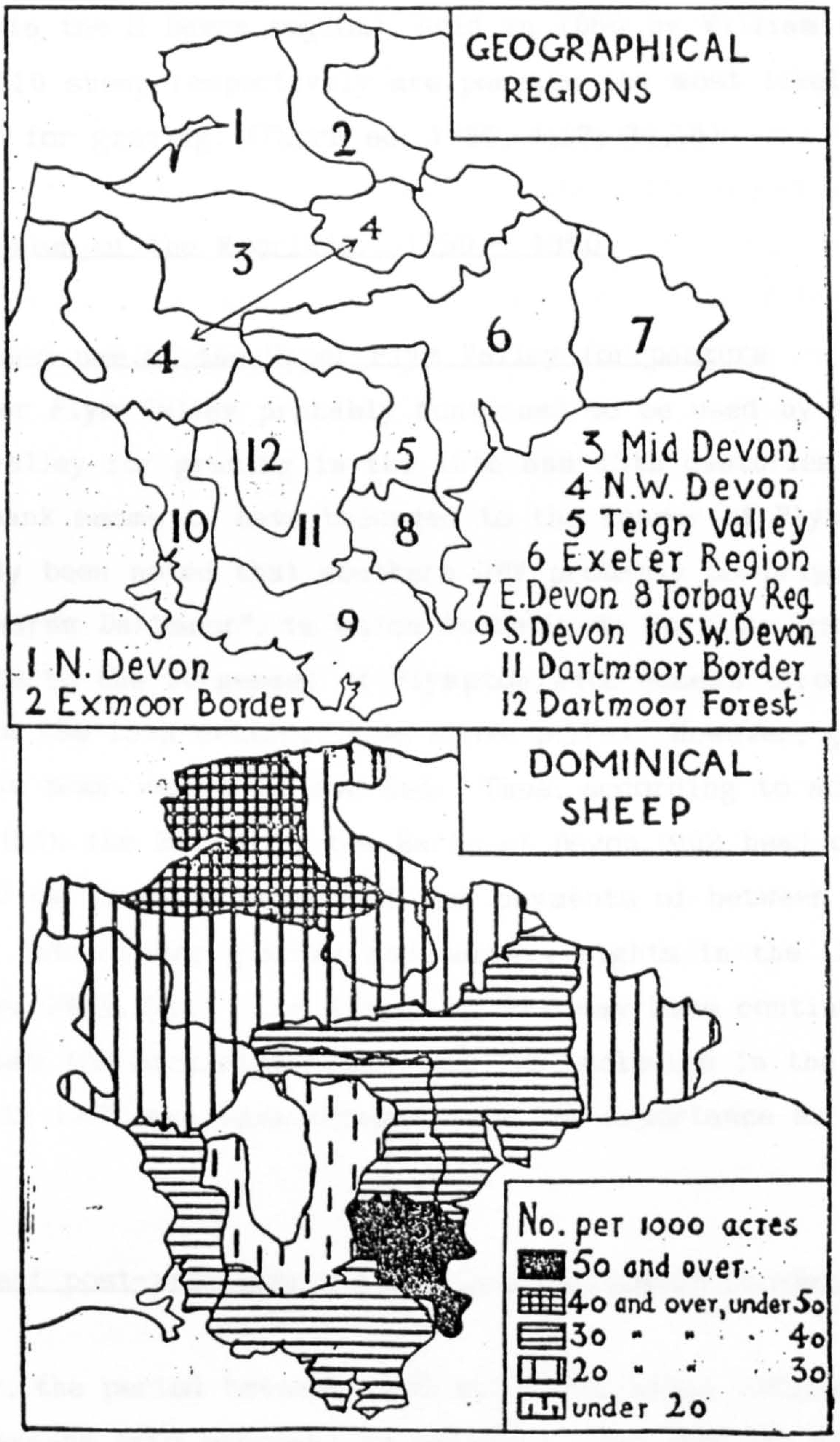


Fig. 3:19 The distribution of sheep in Domesday Devon (from Morgan 1940, figs 2 +15)

A similar situation may indeed have occurred on the S bank of UPV. Thus Lee Moor may have provided grazing, as it did later, for livestock from other manors in the same fief, but situated outside the Dartmoor border region. Plympton and Challonsleigh manors, both in Plympton St. Mary parish (in the S Devon region), held in 1086 by William of Poilley, with 50 and 110 sheep respectively are perhaps the most likely to have used Lee Moor for grazing. (Thorn ed. 1985, 1,17; 21,16)

3.4.3 Colonization of the Moorland, 1150 - 1350

a) The continued use of the Upper Plym Valley for pasture

The Upper Plym Valley probably continued to be used by farms outside the valley for grazing in the 12th and 13th centuries. By this time, the S bank seems to have belonged to the Honour of Plympton. Thus, it has already been noted that southern UPV probably comprises part of "our moor towards Dartmoor", in which Isabella di Fortibus granted turbary rights to the burgesses of Plympton with access through "Heawood" [Lee Wood] in the 13th century. (see above p.179) However, grazing rights on this moor were also awarded. Thus, according to account rolls of manors within the Estate of the Earls of Devon, 902 head of cattle were pastured on the moor in 1294-5 and payments of between £2 and £3 were made by tenants for grazing and turbary rights in the 1280's and 1290's. (Ugawa 1962, 651) The N bank of UPV may have continued to provide pasture for Bickleigh manor, and its inclusion in the Buckland Abbey lands in 1278 may have strengthened its importance as a sheep-walk.

b) The earliest post-prehistoric permanent settlement in the Upper Plym Valley

However, the period between 1150 and 1350, which witnessed the maximum expansion into moorland on Dartmoor, also saw the first permanent post-prehistoric settlement in UPV. It is most likely that the gift in the early 13th century of Trowlesworthy from Baldwin de Redvers to Sampson de Traylysworthy represents the first permanent post-prehistoric occupation of this farm. (WDRO 710/1, 710.748) The wording of the deed indicates that this is a foundation charter. The land is granted directly from the lord of the manor and, therefore, must be at least the first freehold occupation. The deed contains a detailed description of the boundaries in keeping with the initial carving out of an estate. Furthermore, the gift is of land only and no reference is made to a messuage or tenement.

This proposed colonization of Trowlesworthy in the early 13th century would fit neatly into a pattern repeated frequently on the margins of Dartmoor. The period between 1150 and 1350 witnessed widespread expansion of cultivated land and the colonization of the waste in Devon. Thus "by 1350, nearly every name was written on the map of Devon, nearly every line was drawn." (Hoskins 1972, 73) This may be illustrated by just one example from the particularly well-researched estates of Tavistock Abbey; in the 18 square miles of the ancient parish of Tavistock, all but three farm-names were recorded before 1320. (Finberg 1969, 53)

Documentary and place-name evidence for expansion into moorland in the 12th and 13th centuries are supported by archaeological evidence. For example, if the pre-stone wattle-lined turf-walled phase at Houndtor village, Hutholes and Dinna Clerks is discounted (as discussed above p.171), these sites, on the evidence of their pottery assemblages, originated in the 13th or possibly 12th centuries. (Beresford 1979, 146-150) The stone longhouses at Okehampton Park 59 were also dated, on ceramic evidence, to the late 12th and 13th centuries with a timber precursor in the early 12th century. (Austin 1978, 226-8)

Further afield, settlements at Garrow Tor (Dudley and Minter 1962-3, 285) and Bunnings Park (Austin *et al* 1989, 61), both on Bodmin Moor, also originated in the 13th century and, in their review of the Cornish evidence, Preston-Jones and Rose concluded that most of the excavated sites in Cornwall belonged to this "later medieval colonization of marginal areas."

Thus, although a few sites have earlier or later origins (noted above p.172), the weight of the excavation evidence supports a 12th/13th century colonization of moorland. This is further reinforced by environmental evidence. Thus the relatively short-lived phase of cereal production, indicated in the pollen profile at Houndtor is dated to *c.* AD 1270. (Austin and Walker 1985, 149) Furthermore, Austin, Daggett and

Walker suggest that the *Alnus* and *Corylus* decline at the top of pollen zone M-1 in Okehampton Park corresponds to clearance in advance of the agricultural activity of the 12th and 13th centuries, which is indicated by cereal pollen in zone M-2. (Austin *et al* 1980, 48, 53-4) Colonization of the Plym Valley may also account for a reduction in pollen of *Alnus*, *Quercus* and *Betula* with a corresponding rise in pollen of Gramineae, *Plantago lanceolata* and spores of *Pteridium* together with a few cereal grains in zone BB7 at Blacka Brook, which is dated to between ad 820±70 and some time after ad 1210±80. (Beckett 1981, 265) It is important to note, however, that the *Alnus* decline, also found in zone LM5 at the Lee Moor pollen site, may, as Beckett and Simmons have pointed out, be attributed to the activities of tin streamers. (*ibid.*; Simmons 1964, 201)

This massive expansion was, to a great extent, necessitated by the increase in population, which followed the Norman Conquest, though colonization and population increase were not always synchronized. (Miller and Hatcher 1978, 45) Relaxation of the Forest Laws in 1204, undoubtedly encouraged further expansion; previously the whole of Devon had been under the jurisdiction of the Forest of Dartmoor.

Of most relevance to Trowlesworthy and UPV is the emergence in Devon in the late 12th century of:

> "a considerable class of lesser freeholders, most of whom held their lands in socage and by a very small annual rent ... By the end of the thirteenth century they form a numerous class in many parts of the country, particularly in the districts which were not settled at an early date but were left for clearance until after the Norman Conquest." (Hoskins 1952a, 81)

The fertile, easily-cleared lowland manors of E Devon were inhabited and worked mostly by customary (copyhold) tenants. These held their land in return for services to the lord. However, "the western manors, running up to the moors, relied upon a host of free tenants to reclaim their extensive wastes in severalty, acre by acre and field by field." (Hoskins 1952b, 322) Thus the greater number of freeholders in W Devon reflects the colonization of waste. For example, nearly every farm throughout a large area in the neighbouring parish of Cornwood was held in freehold tenure from the 13th century onwards. (Hoskins 1952b, 322)

A further distinction may be made between the socage tenants and earlier freeholders, who held their lands in return for a knight's fee, that is, a portion of the chief lord's knight service. It may be significant that in the list of properties granted for knights' fees on Baldwin de Redvers V's estate, most, including some also on the moorland fringe, were already occupied in 1086. (Cal.Inq.PM I, 175-6) This suggests an earlier phase of colonization, promoted by the chief lord's need to accumulate a sufficient number of knights.

It might appear that few benefits accrued to the lord in the grant of socage tenure. The 4sh. annual rent required at Trowlesworthy was a not inconsiderable sum, but socage was occasionally only of nominal value, consisting of, for example, a rose. (Holdsworth 1927, 28) However, socage tenure may have been granted as an incentive for pioneers to clear the more difficult areas. Furthermore, in Devon, which had an abundant supply of wasteland for common pasture, the lord could relinquish parcels of moorland on the periphery of the manor, without too much loss, and thereby presumably also ease population pressure elsewhere on the estate. In any case, by the process of subinfeudation, the lord maintained control, if only in the demand for a rose, regardless of future alienation of the property.

Thus, Sampson de Traylysworthy may be regarded as a typical freeholder, who obtained a grant from the lord of the manor and carved out a new estate on the moorland margin. He subsequently took the name of the land as his own, in the same way as the witnesses to his charter, including his neighbours, Richard of Meavy, Walter Pomeras of Goodameavy and Thomas of Challeswiche [Cholwich]. (WDRO 710/1, 710/748)

The fields A to G at Trowlesworthy may have been enclosed in the phase of occupation, which began in the early to mid-13th century. They may not have been enclosed immediately, as there is some doubt that the tenement was permanently occupied in 1329, when timber and turf from Trowlesworthy were granted to the occupant of Lulleworthy. (see above p.185; WDRO 710/2)

According to documentary evidence, Gutter Tor and "Rudemor", one of the Ringmoor Down farmsteads, were also occupied in this period. If both

Gutter Tor and Rudemor were vacated by 1404 and probably during the 14th century, it is likely that they were first occupied in the 13th century. (see above p. 197; WDRO 20/247) Certainly Gotetorre seems to have been occupied at least by 1281 (Gover *et al*, 1931,240); The farmstead and Field A probably date to this period.

Hentor is not recorded until 1375, when it appears in an unpublished Court Roll as a personal name. (Gover *et al* 1931, 259-260) This probably does not refer to the earliest occupation of the site and colonization of remote moorland might be unusual in the 14th century period of retreat. It is, therefore, possible that the S field system at Hentor, associated with an earlier house, was enclosed before 1350 or even in the 13th century.

References to Ditsworthy do not appear until the late 15th century. However, these again do not necessarily refer to the earliest occupation on the site and, as has already been noted, the suffix "worthy" has earlier origins. It sems likely that Ditsworthy was occupied well before 1474 but possibly after the first settlement at Trowlesworthy. Thus the Phase I fields at Ditsworthy are more similar in size to the Phase II fields rather than the Phase I fields at Trowlesworthy. It is further possible that Ditsworthy was contemporary with Gutter Tor. Thus it has been shown that the Ditsworthy farmers expanded into the area below Gutter Tor farmstead, after the latter was abandoned in the later 14th century and it is possible that they had settled at Ditsworthy first, because Gutter Tor was then occupied. It might be argued that Ditsworthy, which is perhaps a more desirable site than Gutter Tor, would have been settled first. However, in this case, the converse may be true, that Gutter Tor was occupied after Ditsworthy, so that the latter could still date to at least the 13th century.

The contemporary names for Spanish Lake, Willings Walls, Shavercombe, Shavercombe Foot and Whittenknowles are unknown and, therefore, unidentifiable in the documentary record. In the absence of direct dating evidence, and in the light of evidence from excavated sites in the SW, it may be best to assign these, with the possible exception of Willings Walls, to the period of moorland expansion, if not the 12th century, at least in the 13th. The longhouses at Spanish Lake, Shavercombe, Shavercombe Foot and Whittenknowles closely resemble, on the surface at least, excavated examples dated to this period. Willings Walls seems morphologically distinct and may belong to a later period.

Some arable farming may have been practised; for example, at Trowlesworthy, although no traces of cultivation can be detected, an analysis of soil profiles by Price and Tinsley demonstrated that the soil is of sufficient depth and fertility to support arable use. (1976, 152) Furthermore, rig and furrow in the Phase I fields of Ditsworthy and at Shavercombe farmstead, indicates some arable farming, possibly contemporary with the original enclosure of these tenements. The small quantities of pollen of *Avena/Hordeum* (oats/barley), *Secale* (rye) and *Triticum* (wheat) in a peat column with a basal radiocarbon date of ad 1140±110, taken from the saddle between Great Trowlesworthy Tor and Shell Top, presumably relate to these arable activities. (Beckett 1981, 265-6) Pollen grains of *Avena/Hordeum* are slightly more numerous, though no dominant cereal can be distinguished in such a small sample. However, *Secale* accounted for two-thirds of the cereal pollen in a sample dating to the Medieval period at Holne, while *Hordeum* predominated in pollen zone M-2, dating from AD 1240+70, in a sample from Okehampton Park. (Maguire *et al* 1983,87; Austin *et al* 1980, 49-50)

Considerable efforts were made to reclaim the moorland for cultivation. The process of beating, or beat-burning, is described in the 16th century by Hooker:

> "For in the places which be somewhat remote and farr from the seas and the grownd is but thynne they do use to beate the same that is they do cutt it into turffes which beinge made drye they do bringe the same into hyllockes and do burn it and the ashes thereof they do cast and sprinkle abroade upon the grownde." (Blake 1915, 343; Finberg 1969, 91-4)

However, the earliest known reference to the practice is in an account of 1225-6 for the Plympton and Topsham manors, belonging to the Earls of Devon. (Ugawa 1962, 635) The practice may well have been adopted at an early date by the tenants of the Earls of Devon, while the place-name Beatland Corner, just to the W of UPV in Shaugh Prior parish is probably derived from this process.

However, much of this early permanent settlement in UPV was probably associated with pastoral farming. Thus the clitter-strewn enclosures of the earlier southern field system at Hentor, the 15.76 acre Field A at Gutter Tor, and the large areas of Ringmoor Down, defined by banks and ditches as well as fields associated with the individual farmsteads, such as that bounded by Mons 275a, b, c and 276a at Legis Lake and the early phase of the field bounded by Mons 331, 326 and 337 at Legis Tor were probably all designed to accomodate livestock. (Sheet 14) The absence of field systems at Spanish Lake and Shavercombe Foot suggests that these also depended on a pastoral economy. However, as noted above(p. 80), small fields, such as those enclosed in Phase I at Trowlesworthy are also suitable for pastoral farming.

Arable farming could still have been practised in conjunction with pastoral. Thus Fox notes the common practice in Post-Medieval Devon of convertible husbandry, in which fields were sown with grass, for mowing (hay) or for grazing (ley), in between periods of arable cultivation. (1971, 102) A typical rotation consisted of three years of crops, followed by seven years of grass, so that ten fields of about the same size could accomodate each stage of the cycle. (Fox 1971, 104) It is possible that field systems, for example, at Ditsworthy, were extended at a later date to allow such a rotation, but some combination of arable and pastoral, possibly involving a shorter cycle in a smaller number of fields, might also have been practised in the earlier period of settlement.

This has some support in the environmental record. The arable/pastoral ratio of pollen in zone M-2 at Okehampton Park, dating from the 12th and 13th centuries indicates that the economy was "neither predominantly pastoral nor predominantly arable". (Austin *et al* 1980, 49) Arable and pastoral activities are both represented in the Medieval levels of the Blacka Brook, Lee Moor and Votter Common pollen sites, but the greater amounts of *Plantago lanceolata* pollen and *Pteridium* (bracken) spores suggest "a continued dominance of pastoral activity" in and around the Plym Valley. (Beckett 1981,265)

Finally, there is evidence to suggest that while Sampson de Traylysworthy's tenure was probably the first permanent occupation of Trowlesworthy, it was preceded by occasional temporary use. It is significant that the land granted to Sampson already had a name, derived from a ME personal name, Travell. (Gover *et al* 1931,259) A similar pattern was observed by Hoskins (1952b, 323) at Cholwich, where the land was already named "Cholleswyht" in the early 13th century foundation charter. Hoskins concluded that any earlier occupation must have corresponded to occasional cultivation of the outfield, a practice documented frequently elsewhere. Thus, Finberg (1952, 284) quotes from a 13th century grant for Blackmoorham in Tavistock, in which the tenant is given the right of common on Whiteborough Down "when it lies untilled, but it shall be lawful for the abbot and convent to cultivate the said waste whenever they shall think fit." This and other examples cited by Finberg suggest that parcels of outfield could be taken into cultivation when necessary and susequently be allowed to revert to waste. The "outfield" is normally associated with the open field system of agriculture, but intermittent cultivation of common pasture could still have been practised on the Dartmoor margin.

Furthermore, Hoskins (1952b, 317) suggests that this practice may explain the discrepancy in Domesday Book, particularly on upland manors, between the amount of ploughland and the actual number of ploughs. For example, at Radworthy, the highest manor on Exmoor, only one plough was recorded, though there was enough land for six ploughs. (*op.cit*, 318)

Similarly at Spitchwick on E Dartmoor, only four ploughs were found on eight ploughlands. (*ibid.*) Therefore, the occasionally-cultivated outfield may have been included in the calculation of ploughland.

No evidence of earlier temporary cultivation can be detected at Trowlesworthy, though no clear traces of Medieval cultivation have been found at all. However, the patch of rig and furrow on the W edge of Ringmoor Down, later partly enclosed by a field, **Mon** 270a, may represent short-term cultivation of the common pasture by a farm on Lynch Common. The unenclosed rig and furrow, **Mon** 338, E of Legis Lake may also correspond to temporary cultivation of pasture, but may date to a later period.

c) <u>The influence of Buckland Abbey on UPV</u>

It has been shown that after 1278 the N. bank of UPV up to the boundary with the forest of Dartmoor was owned and administered by Buckland Abbey. It may therefore be appropriate here to consider the impact of the new landlords on UPV.

It is well-known that, in rejecting the increasing worldliness of other orders, the Cistercians sought a simple life of labour and prayer. (Brooking Rowe 1875, 332) In pursuit of these ideals, "the Cistercian made agriculture his business" (*ibid.*), and came to be identified with sheep-farming and the wool trade. Lay-brothers [*conversi*] operated large-scale sheep-farming particularly in Lincs, Norfolk and Yorks, but their endeavours could cause considerable upheaval in rural communities. (Stephen n.d., 20)

> "this policy of centralised farming making use of direct monastic labour cut across the traditional agricultural economy of the countryside, and in their single-mindedness the early Cistercians did not shrink from evicting the existing population of an estate if it seemed that the land could be better exploited by being "reduced to a grange". (Gilyard-Beer 1986, 9)

Thus, Fountains Abbey was responsible for the depopulation of hamlets of Layton, Greenberry and Thorpe Underwoods. (*ibid.*)

The wool trade was undoubtedly important to the Cistercian houses in Devon, despite coarser wool than that produced in the eastern counties. Thus in 1280, Forde Abbey was exporting wool to Flanders and, in 1315, Forde, Newenham and Buckfast Abbeys (and Torre Abbey) were trading with Florentine wool merchants. (Finberg 1969, 146-7) Florence, and particularly Flanders, were the major centres of the cloth industry. (Postan 1975, 214) The enrolment of the Abbot of Buckfast in the Merchants' Guild of Totnes in 1260 was probably a reflection of Buckfast's contribution to the wool trade. (Stephan n.d., 26) Buckland was not excluded from these activities; when, in 1347, Edward III requested wool from the major abbots, as a loan for the French wars, the Abbot of Buckland was second on the list of Devon abbots. (Gill 1968, 18)

Lady Fox (1958, 149-152) suggested that the farmstead excavated on Dean Moor might correspond to the house and enclosure, said to be occupied by lay-brothers of Buckfast Abbey. The existence of such a farmstead is indicated by a document in the Buckfast Abbey chartulary:

> "The Abbot and monks of Buckfast, always, up to the time of the first Plague (1348-49), kept on their moor of Buckfast a lay-brother, one succeeding another without interruption, living in a house on Buckfast Moor, having a shepherd under him to keep constant watch over the flocks and herds of the said monks on Buckfast Moor and Brent Moor, and to guide and shut in at night the said cattle within an enclosure of a hundred acres adjoining the said dwelling."
> (Register Grandisson, 1608; transl. Hamilton 1906, 74)

It might be wondered if a similar arrangement was undertaken on the N bank of the R. Plym. However, there is no evidence that tenants were ever cleared from Buckland property to provide more land for sheep. A grange was established in the manor of Cullompton, but probably simply to aid administration of this distant parcel of Buckland territory. (Gill 1968, 19) In general, Buckland may have relied less on the labour of lay-brothers than other Cistercian houses. It was the last Cistercian house to be founded in Devon and, by 1278, "the early simplicity of the order was already being lost". (Gill 1968, 14) The Cistercian houses, at first repudiated the large estates (and revenues) required, for example, by the Benedictines. Yet, Buckland accepted the three large manors of Buckland, Bickleigh and Walkhampton amounting to 20,000 acres, as well as the manor of Cullompton. (Brooking Rowe 1875, 357-8; Gill 1968, 14) Moreover, as Gill points out, the grant of the advowsons of the churches of Buckland, Bickleigh and Walkhampton and the chapel of Sheepstor, and the hundred of Roborough suggests they were now prepared to accept parish and feudal responsibilities. (Brooking Rowe 1875, 358; Gill 1962, 14)

The emphasis on working their own lands may have been waning throughout the Cistercian order by the early 14th century. Thus, Hamilton points out that where "a regular colony of lay-brothers" once inhabited Buckfast Moor, only one or two "with their secular dependents" remained after 1310. (Hamilton 1906, 74) This trend must have been accelerated by the Black Death which would have affected the lay-brothers as much as the population elsewhere. (see below p.221) Therefore, while it is tempting to visualise a colony of white monks at Whittenknowles or Legis Lake, it is perhaps unlikely that a community only founded in 1278 would have operated according to the old regime against a background of changes elsewhere.

A further argument against this, though still far from conclusive, is the evidence that properties in UPV were leased to tenants at some time in the 14th century. The preponderance of documents dating to Thomas Olyver's reign as Abbot in the late 15th century may not simply be a result of increased letting of property, as Gill suggests. (1968, 36) It could also reflect increased survival of documents, while those 15th century documents themselves demonstrate the existence of earlier tenants. The tenure of John [?] Torruyng, named in a 1404 lease, as the previous holder of Smallacombe, just W. of UPV, must have begun in the later part of the 14th century. (WDRO 70/247) Tenants of Rudemor and Guttor, who had surrendered their lands on Rydemoredon before 1404, must also have been in occupation in the 14th Century, not long after the foundation of the Abbey. (WDRO 70/247)

If Buckland Abbey rented out its UPV property it may be wondered how the land was administered and how the tenants were treated by their landlords. The Estates of Tavistock Abbey certainly seem to have been well-managed. Finberg (1969, 113-5) notes the high cereal yields and concludes that "the monks of Tavistock raised crops well up to the highest standards of their contemporaries." There is little direct evidence about Buckland but Brooking Rowe asserts that the Buckland monks "appear to have lived a quiet unostentatious life - not greedy of wealth, or desirous of adding to their possessions, not quarrelling with their neighbours". (1875, 337) Furthermore, the reaction of rural communities in Devon to The Dissolution (see below section 3.4.5) suggests that they had been treated fairly under monastic rule.

3.4.4 Retreat and Consolidation.

Colonization throughout England seems to have reached its peak by the mid-14th century. Following maximum expansion came a period of consolidation, involving retreat from the most marginal areas and amalgamation of surviving holdings. Much of this occurred in the aftermath of the Black Death, 1348-9, discussed below, but the regression seems to have begun in the earlier 14th or even later 13th centuries.

This regression can be traced in documentary sources; for example, a "decay of rents" was noted at Helston-in-Kirrier in 1304-5, a "flight from holdings" was recorded at Tintagel in 1297-8 and at Teignmouth some of the tenants had "relinquished their holdings out of poverty" in 1281. (Fox 1971, 155) Some holdings were also abandoned on Dartmoor; thus, in the bailiff's accounts for "Dartmoor Manor" within the Forest of Dartmoor of 1301-2, "decay of rent" was recorded for a ferling of land at Sherling and half a ferling at Walebrook "which was in the King's hands for default (ie. absence) of a tenant." (Moore and Burkitt 1890, 11)

This process continued and gathered momentum throughout the 14th century. Thus the accounts for 24-25 Edward III (1350-1) contain a list of unoccupied tenements, which are "in the hands of the lord for default of tenants". (Moore and Birkett 1890, 21) These holdings include "Black Staith, Edithull, Walebrook, Wodeford [Wokeford], Brentford, Blackfurses, Shortermead, Algarslake, Thurburnwood [Sherborne Wood], Brantclive and Walford." (*ibid.*) (FN 1) In 1358-9, Blakefurses, Edithull, Sherborne Wood, Algarslake and Woldford [Wokeford] are still unoccupied while Wendford, Collake, Bromstontoryn, Bromstonwode and Donabrigge Hill have become vacant. (*op.cit.*,23) By 1403-4 Odehull [?Edithull], Wendford, Wokeford, Culloc [Collake], Brounstountor [Bromstontoryn] and Donaghbrigg Hill [Donabrigge Hill] are still unoccupied. (*op.cit.*,31)

Of some significance is the permanence of some depopulation; thus Walebrook, unoccupied in 1301-2, was still vacant in 1350-1, and several holdings vacated in the 1350's remained unoccupied in 1403-4. Tenements omitted from the lists in 1358-9 and 1403-4 may have been reoccupied, though in the light of other evidence, they were probably amalgamated with existing holdings. For example, within the estates of Tavistock Abbey, the 5½ ferlings at Dunscombe on the western margins of Dartmoor, which were occupied by three tenants in 1336, had been amalgamated with Taviton into a single holding by 1387. (Finberg 1969, 52) Similarly, the seven individual holdings recorded in 1336 at Crowndale, S. of Tavistock town, had been consolidated into one holding by 1396. (*ibid.*)

FN 1 Burnard and Prowse identified Thurburn Wood as an error for Sherborn Wood ie. Sherberton, and both Wodeford and Woldford as errors for Wokeford ie. Week Ford.(1893, 505, 508)

Retreat from the moorland in the 14th century is also indicated in the archaeological record. Thus, on the evidence of the pottery assemblages, Okehampton Park 59, Houndtor village, Hutholes and Dinna Clerks on Dartmoor, Bunnings Park on Bodmin Moor and Lanyon, Tresmorn and Treworld on the N Cornish coast were all abandoned in the first half of the 14th century. (Austin 1978, 228; Beresford 1979, 146-150; Austin *et al* 1989, 61; Wilson and Hurst 1965, 210; Beresford 1971, 67; Dudley and Minter 1966, 54) The ceramic evidence is supported by environmental analysis: thus, according to the pollen profile at Houndtor "local cereal production ceased" at some time after *c.* AD 1300-1310. (Austin and Walker 1985, 151)

14th century desertion can be attributed to a range of factors. In the country as a whole, climatic deterioration following the Little Optimum caused a series of crop failures from the second half of the 13th century, culminating in the disastrous harvests of 1315-22. (Lamb 1968,8; Kershaw 1973, 6-20) Loss of sheep, cattle and oxen in the livestock epidemics, which accompanied the latter, caused further hardship. (Kershaw 1973, 20-9) The consequent increased mortality rates and impoverishment of a population already "so close to the margin of subsistence" may have led to the abandonment of many holdings. (Miller and Hatcher 1978, 60)

Wetter conditions in this period on N Dartmoor are indicated in the pollen analysis from Okehampton Park. The presence of pondweed pollen throughout zone M-2 suggests that "pools of standing water must have formed", though impeded drainage may also have played a part. (Austin *et al* 1980, 49) However, Austin, Daggett and Walker point out that upland farms on better-drained slopes were less affected than low-lying farms by the rainfall, which, for example, ruined the 1314-16 harvests. (*op. cit.* 54; Hatcher 1970, 85) However, it may also be suggested that if marginal settlements coped better with excessive rainfall, they may still have been affected indirectly by crop failures elsewhere, for example, by migration to abandoned lowland farms. Transfer to better low-lying farms may even have been forced upon tenants by landlords seeking to maximize rentals.

An even greater upheaval in settlement patterns and land use may have been caused by the Black Death. It has been estimated that over a period of 18 months in 1348-9, the Black Death caused the deaths of between 20% and 40%, and possibly 50% of the national population. (Postan 1975, 41; Titow 1969, 69-71) Devon did not escape the epidemic, and, indeed, evidence suggests that "the effects of the Black Death were more severe here than elsewhere". (Hoskins 1954, 169)

The total number of casualties can only be speculated upon but Hoskins suggests that the documented mortality rate of 49% within the clergy may have been almost equalled in the lay population. (Hoskins 1954, 169) The attrition among the clergy itself, holds implications for the management of the N. side of UPV. There is no recorded evidence of the death rate at Buckland Abbey, but it is likely that the poverty, which, according to the White Book of Tenures in Cornwall in 1357, excused Buckland Abbey from charges payable to the Forest of Dartmoor, was a result of the epidemic. (Brooking Rowe 1875, 800) The Black Death, as well as "devastation of the Scilly Isles by pirates" was blamed for the near-bankruptcy of the neighbouring Tavistock Abbey in 1351. (Finberg 1969, 27) The abbot of Tavistock himself succumbed to the plague, as did the abbots of Buckfast, Torre and Hartland, and the Priors of St James' and St Nicholas' in Exeter, Barnstaple, Pilton and Modbury. (Register Grandisson, lxvii-lxix) Records usually only name the abbots, but at the Cistercian Abbey of Newenham in E. Devon, only three survived out of a community of 26. (*op.cit* lxviii)

An isolated moorland location such as UPV may well have fared better than densely-populated urban areas, though even in the rural parish of Templeton in N. Central Devon, which had no village, "the dead were collected by the cartload from the scattered farmsteads, and taken by night to the mother-church of Witheridge for burial". (Hoskins 1954, 169)

However, the effect of the Black Death in the uplands may have been just as great, if not greater, than in the more densely-populated lowlands. The increase in the number of tenements, unoccupied on Dartmoor Manor after the 1350's noted above, may perhaps be attributed to the effects of the Black Death. As in the case of the crop failures of the early 14th century, desertion of moorland settlements could have been caused directly by the deaths of the tenants, or by the migration of surviving tenants elsewhere.

Events in UPV, as far as they are known, seem to follow the pattern evident elsewhere. It is possible that the absence of records for Trowlesworthy from 1329 to 1403, signifies a temporary break in occupation, but a gap in the documentary record is hardly sufficient evidence. Of greater significance is the lease, granted in 1404, for a tenement in Smallacombe with common pasture on Ringmoor Down including the lands of "Rudemor and Guttorr". (described above p. 196; WDRO 70/247) It is clear that Rudemor (Ringmoor) and Guttorr (Gutter Tor) had been vacated relatively recently; the lease reserved the possiblity that the tenants might return. These lands must, therefore, have been abandoned at some time during the 14th century and the lease thus provides the strongest documentary evidence in UPV for 14th century depopulation.

The lease also demonstrates that the lands of vacant tenements were incorporated in the common pasture, until the tenants might return. Similarly, vacant tenements on Dartmoor Manor seem to have been appropriated by the Chase (or Forest) of Dartmoor; thus the accountant for Dartmoor Manor claimed, in 1403-4, that the Chase, rather than the Manor, should be charged for the herbage at the vacant tenements, as the tenements were then "within the Chase". (Moore and Birkett 1890, 31)

Presumably, abandoned tenements would eventually be permanently included in the common pasture, or amalgamated with other holdings. The absence of any later references to Rudemor and Guttorr suggest that these lands were included in the common pasture on Ringmoor Down, granted in later leases, such as to Derkysworthy in 1493. (WDRO 70/183) However, archaeological evidence suggests that a distinction was made between Rudemor and Guttorr, so that, while Rudemor may have been included in the common pasture, Guttorr may have been amalgamated with another holding. It was suggested above (see p.143) that the second phase of fields below Gutter Tor were enclosed and used by tenants of Ditsworthy . It is probable that this enclosure took place in the aftermath of the 14th century regression when Gutter Tor was abandoned.

Hoskins points out that, in ecclesiastical manors in the Post-Medieval period, enclosure was encouraged by surveyors, "whose primary aim naturally was to enlarge the cultivated area and increase rents".

(1943, 85) A similar aim by Buckland Abbey may have persuaded the Ditsworthy farmers to expand into the area below Gutter Tor. The possible practice in UPV of convertible husbandry, requiring a certain number of fields of the same size, depending on the length of the cereal/grass rotation, has already been noted. While there is no corroborative evidence for the practice at Ditsworthy, it may be suggested that the expansion to Gutter Tor would have provided a larger number of similarly-sized fields suitable for a rotation. The comparable sizes of Fields B, F and H at Ditsworthy and Fields C, D, E and F at Gutter Tor is particularly striking. (See Table 3:2)

Thus a process of retreat and amalgamation, recorded in field and documentary evidence elsewhere on Dartmoor and in the SW, can also be identified in UPV. The cause of the desertion of Gutter Tor and Ringmoor settlements can only be speculated upon. The accounts for Dartmoor Manor might suggest an acceleration of the retreat from the moor in the aftermath of the Black Death, but the archaeological evidence from excavated sites suggest that desertion was virtually complete in the first half of the 14th century. Furthermore, it is notable that while retreat from Dartmoor had begun in 1301-2 at Sherling and Walebrook, other parts of the moor were still being colonized; 96 acres were reclaimed by tenants at Dunnabridge and 8 acres at Pizwell in 1305-6. (Moore and Burkitt 1890, 12) Thus individual sites may have been affected by local circumstances and it may a mistake, as Austin, Daggett and Walker point out (1980, 55), to attribute retreat from the moorland, a process, which took place over a period of about a century, to a single cause. It is also likely that, as Austin, Gerrard and Greeves point out (1989, 21), lowland events and settlement patterns had a greater influence on moorland sites than has previously been appreciated.

3.4.5 Post-Medieval Farming: Mid 16th. to Mid 17th. Centuries.

a) Introduction

A period of between 150 and 200 years of retreat and consolidation seems to have followed the agrarian crisis of the early 14th century and the Black Death. This may be exemplified by the absence of new settlements between 1350 and 1500, noted by Hoskins. (1943, 88) However, colonization received a fresh impetus in the mid-16th century involving the creation of new settlements and the extension of existing ones. The effect on UPV of this renewed reclamation will be discussed below, but, first, the turbulent years following the Dissolution of the monasteries and the Western Rebellion, which marked the beginning of this period, and also affected UPV, should be considered.

b) The Dissolution of the Monasteries and The Western Rebellion

The Western Rebellion, which erupted in Devon and Cornwall in 1549, was ultimately a religious dispute. The Act of Uniformity of January 1549, which abolished the Latin Mass and imposed an English Prayer Book, was deeply resented by a rural population, inherently opposed to change. (Rowse 1941, 262) Open rebellion broke out first at Sampford Courtenay on the northern margin of Dartmoor, when the Prayer Book service was introduced on Whit Sunday, 9th June. (*op.cit.* 263) However, although the Act of Uniformity was "the efficient cause of the rising in the west" (*op.cit.* 262), underlying grievances played their part. These grievances developed in the wake of the Reformation and the Dissolution of the monasteries, and have direct relevance for UPV. As R. N. Worth concluded of the Rebellion:

> "This movement was undoubtedly, in one sense, economical. Twenty-four religious houses, some of great wealth and extensive charities had been suppressed in Devon. The poorer dwellers in their neighbourhoods felt the loss severely. Not only did alms cease, but the new holders of the church estates proved harder landlords than the monks. The progress of enclosure, and the substitution of pasture for tillage, increased this disadvantage. Little was required to fan the vast amount of smouldering discontent thus created into flame."
> (R.N.Worth 1886, 20-21)

In support of this view, while the deposition ("the Articles") made by the rebels was chiefly concerned with liturgical matters, the last two demands hint at these underlying issues. (Rowse 1941, 271-2) The request that "no gentleman shall have any more servants than one to wait upon him except he may dispend one hundred marks land" (quoted in Rowse 1941, 272), signifies to Rowse "the element of class-feeling in the Rising ... at this time of increasing disparity between classes, when the gentry were drawing further away from their dependents." (Rowse 1941, 272) The final demand was for the restoration of half the abbey and chantry lands, which had been distributed after the Dissolution, so that two places, where "devout persons .... shall pray for the king and the Commonwealth" could be established in each county. (quoted in Rowse 1941, 272). Behind this request might be seen another attempt to restrict the newlyincreased power of the gentry and to restore a more agreeable regime of land management.

It is clear from documentary evidence that UPV was directly affected by these events. The transfer of the N. bank of the R. Plym from Buckland Abbey to the Slanning family is fully recorded (and noted above p.199). However there is no indication of any consequent detrimental effect on UPV tenants. Surviving records reveal the great increase in importance and wealth of the Slannings, stemming from their acquisition of some Buckland Abbey lands. (Jones 1887, *passim*) The founder of the dynasty, John Slanning was a London lawyer, Steward of the Inner Temple, and only an esquier when he died. (Jones 1887, 452-3) However, there is nothing to suggest that the Slannings were "harder landlords than the monks." (R.N. Worth 1886, 21) Leases issued soon after Slanning's purchase of the property, include no harsher rents and conditions than those imposed by the Abbey. For example, the lease for Ditsworthy issued by John Slanning to Elie Shullibeare in 1552 for 70 years, which required suit of court leet, millsuit and repair of weirs and fisheries is hardly more restrictive than the lease issued by the Abbot of Buckland in 1493. (WDRO 70/156; 70/183). By 1676, Ditsworthy was established as a warren, which enjoyed sufficient security and prosperity to allow its survival into the 20th Century. (WDRO 70/189)

In 1673, Ringmoor Down was described as "an excellent pasture for the sumer" (DRO 346M/E424), but it is most likely that "substitution of pasture for tillage" (R.N. Worth 1886, 21), took place long before the Slannings took over.

It is clear that tenants of other monasteries were adversely affected by the substitution of secular masters. For example, in 1541, the inhabitants of Buckfastleigh complained that Sir Thomas Dennys, who had acquired the lands of Buckfast Abbey was withholding from them "such right and use ... as they say they have had time out of mind, in and to the common of the moors." (Moore and Birkett 1890, 45)

It is also clear that "the smouldering discontent" felt in Devon and Cornwall did reach the Plym Valley. The confiscation of Trowlesworthy from Nicholas Harrys for his part in the Western Rebellion has already been noted. (see above p.188) Property was confiscated " by reason of his disobedience & rebellion contrarie to his naturell dutie of liegeance [allegiance] yn the late styer [?stir] & commotion" but the exact nature of "his disobedience and rebellion" is not disclosed. (WDRO 710/7; see documentary extract 3) It is clear that the forfeiture made on 9th August 1549, in accordance with a proclamation issued on 11th July (WDRO 710/7) was one of many made by Russell, Lord Lieutenant of Devon in the ten days following the siege of Exeter, in August 1549. As well as rewarding his chief allies, notably the Carews with lands of the rebel ringleaders, such as John Winslade and Humphry Arundel, he also gave "to many others who had served with him both prisoners to ransom and their lands and goods". (Rowse 1941, 278). Crokker's actions are unrecorded except that he performed "trew faithfull and right acceptable servyce ... to the right worshipfull [?] th' archdeacon". (WDRO 710/7)

Nicholas Harrys may also have forfeited his life in the Rebellion; his widow was left to deal with the aftermath and attempt (in vain) to buy back Trowlesworthy in January 1550. (*ibid.*) While some deaths occurred (though rather less than Hooker claimed) at the rebels' last stand at Sampford Courtenay, rather more lives may have been lost in Russell's severe punishment afterwards. (Rowse 1941, 278-9, 281-2) His mercy towards common people, and severity towards ringleaders suggests that, if Harrys was executed, he may have played a prominent role. However, his name does not appear in any of the published accounts. (Rose-Troup 1913; Rowse 1941, 253-290; Sturt 1987)

c) <u>Reclamation and Rebuilding after 1550</u>

There is no suggestion that these events caused the renewed reclamation, which occurred after 1550. However, possibly the release of large tracts of land from monastic control, "freeing so much .... wealth from the dead hands of the monasteries .... paved the way for the economic advance of Elizabethan England." (Gill 1968, 42) Certainly the large number of leases issued in the 1550's and 1560's for land, formerly belonging to Buckland Abbey suggests considerable reorganization of the property, though, as always, differential survival of documents may have played a part. (WDRO Accession Register 70)

Hoskins suggests that the Post-Medieval reclamation occurred in three ways. (1943, 85) Firstly, and most importantly, large blocks of ten, twenty or even fifty acres were added to existing farms. (*ibid.*) Another method was the piecemeal assarting of waste, mostly by "cottagers and labouring families". (*ibid.*) Finally, and much less frequently than in the earlier periods of colonization, woodland, heath and moor were cleared for the creation of new farms. (*ibid.*) It is in the first category, to which, it is suggested, the 59.83 acre (24.21 ha) field system of northern Hentor belongs. Here, the 18 fields would have given plenty of scope for convertible husbandry, though the average size of 2.54 acres is somewhat smaller than the Post-Medieval average for Dartmoor of 3.3 acres. (Fox 1971, 86)

It was also suggested above that Hentor House, **Mon 910n**, a two-storied lobby-entry house, was built in the 17th century on the site of an older structure, probably a longhouse. (see p.127 and p.169) This fits into a pattern of renovations or complete rebuilding of houses, repeated all over Devon between 1570 and 1640, a period, known as "The Great Rebuilding". (Hoskins 1966, 23; 1963)

Both land reclamation and house improvements may be attributed to "the abundance of ready money" enjoyed by farmers from *c.* 1570 until the Civil War. (Hoskins 1966, 25) This was made possible by the combination of rising prices for farm produce and the relatively low cost of rent and labour. (Hoskins 1966, 23-5) In addition, the three-life lease, prevalent in Devon, and documented at Trowlesworthy and Ditsworthy, provided sufficient security of tenure to encourage improvement of property. Thus it may be suggested that the rebuilding of Hentor House and the enclosure of the field system on northern Hentor plain were related events, which took place during this period.

The present house at Ditsworthy, **Mon 880m** is thought to have 16th century origins (OS Card), and the two-storey house at Trowlesworthy, destroyed in the 1800's but sketched by Henry Woollcombe, may also date to this period. (See Fig. 3:4) (WDRO 710/751) A second storey and chimney are usually regarded as Post-Medieval improvements and these could have been added to an existing longhouse. (Alcock and Hulland 1972, 35; Hoskins 1966, 25) It is further possible that the renovation of the house is contemporary with the enclosure of the Phase II field system to the E, though there is no evidence to substantiate this. By this time, Trowlesworthy was a sizeable stock farm; thus, as noted above, in 1570/71, 100 sheep, ten cows and two mare colts were "all at Troulsworthy". (WDRO 710/751) (see above p.191)

It may also be argued that the new field systems at Hentor and Trowlesworthy were laid out as a result of tin working. It is in the period after 1550, that the bulk of the extant documents relating to UPV tinworks belong. Although this undoubtedly reflects some differential survival of documents, it may also indicate a period of extensive tin working. The tinworks in Hentor Brook and Meadow, documented in 1527, clearly interfered with the earlier field system at Hentor; the S boundary, **Mon 519**, has been interrupted by tin streaming. (WDRO 72/990/15) Furthermore, the tinworks on the R. Plym may have disturbed the Phase I fields at Trowlesworthy. It is, therefore, possible that such tin working necessitated a transfer of agricultural activity further away from the river banks, and may even have financed it. Thus the tinners' wealth, which supposedly helped to finance extensive rebuilding of moorland churches in the 15th and 16th centuries may have contributed to the Post-Medieval farm improvements. (see below p.356)

3.4.6 <u>Later Farming: Mid-17th. to 20th. Centuries.</u>

By the mid-17th century, two of the tenements in UPV, Trowlesworthy and Ditsworthy, had become rabbit warrens and more were to follow: Legis Tor was enclosed as a warren by the early 18th century and Hentor was given over to rabbits in 1807.(see section 4.2) The later warrens may simply have been encouraged by the obvious success of the earlier two. However, Trowlesworthy and Ditsworthy warrens were part of the second phase of warren expansion observed all over Britain in the 17th century. As noted below (see p.247) farmers, particularly in marginal areas, may have turned to warrening in the face of falling grain prices from 1660 to 1750, and declining wool prices throughout the 17th century. (Sheail 1978, 348) Extensive tin streamworking in the area, which is suggested by the numerous documents relating to UPV tinworks in the 16th and 17th centuries, may also, as Roger Mercer has suggested (pers. comm.), have encouraged tenants and/or landlords to adopt a more passive form of land use, which might conflict less with tin working.

Climatic deterioration since the Little Optimum may also have made the moorland region less viable for agriculture than it was in the earliest phase of Medieval colonization. The Rev. John Swete, travelling westwards towards Shaugh Prior parish from Cornwood in 1797, remarked on the poor quality of the pasture:

> "As we ascended towards the Moors there appear'd a vast tract of country whose aspect was S West declining by a gradual slope .... at present it had a wet and cold appearance and was productive of [?] rush and coarse grass, which, as the farmers express themselves, had no nature in it, that is it might keep stock alive but would never fatten"
> (DRO Swete MS vol 14, 55)

However, Swete also believed that such land could be productive if improved and observed that the farmer at Cholwich Town, just to the S of UPV, "had lately inclosed a portion or two, which after burn beating, had produced him two good crops of turnip and wheat, which had amply repaid his toil and expence." (*op. cit.* 56)

Some farming did, indeed, continue in UPV. Thus Hentor was still under cultivation in the 18th century. Information on this period relies on a brief paragraph in Crossing's Guide to Dartmoor:

> "In the second half of the eighteenth century this farm was in the occupation of a man named Nicholls. When he reliquished it Nature resumed her sway, and the fields in which it is said as many as ten oxen were employed in ploughing, soon became a part of the moor again."
> (Crossing 1912, 432)

However, it may be assumed that the farm was occupied continuously from the rebuilding of the house and extension of the fields in the later 16th and early 17th centuries, until it became a warren in 1807. The refurbishment of the late 16th / early 17th century field system on northern Hentor plain, indicated in the matrix analysis (Fig. 3:9) may then date to this 18th century use.

Some arable and pastoral farming were also practised in conjunction with rabbit warrening. The Tithe Maps of the mid-19th century show that some fields around Ditsworthy and Trowlesworthy Warren Houses were devoted to arable and meadow as well as pasture. (see Figs. 3:5 and 3:13) These may have been used to grow fodder for the rabbits, though corn was also being grown in the early years of the 20th century at Trowlesworthy. (Le Messurier 1966, 58)

Other livestock may also have been kept on the warrens. For example, at Ditsworthy, warreners were permitted to keep as many "beasts and cattle" in 1676, and as many "beasts cattle and sheep" in 1762, as could be wintered on the premises. (see below pp.260-1) This was a standard clause in leases and may not necessarily have been exploited. However, from 1839 to 1849, Nicholas Ware of Ditsworthy also occupied Ringmoor Down, presumably for livestock other than rabbits as there is no sufficient enclosure on the Down for the latter. (DRO PW2) Otherwise Ringmoor Down was let out, presumably for grazing for farms outside UPV, as in preceding centuries. For example, it was occupied in 1856-8 by Donald McKenzie, the farmer of Nattor (SX 572 673). (DRO PW2) Grazing seems to have changed hands quite frequently; thus Ringmoor Down was used by Mark Northmore from 1860 to 1863, by John Westlake in 1864 and by Richard Chudleigh from 1865 to 1868. (DRO PW2)

Some arable and pastoral farming may have been undertaken at Eylesbarrow during the lifetime of the Mine, possibly to feed the miners or, at least, the captain and his family, living in the Account House, **Mon 1134a**. Thus in the Tithe Map of 1842, the property of "Ellisborough" is occupied by James Henry Deacon, the mine agent, and enclosures and their uses are listed. (WDRO MFC 717) The "field", corresponding to the area enclosed by walls, **Mons 1102a, 1102b, 1102d** and the reservoir, **Mon 1100**, was devoted to pasture. (Sheet 31) The "garden", a small area to the S of the timber house, **Mon 1130**, and the "plott", which corresponds to the area between the garden and the wall, **Mon 1102d**, were also used for pasture. Another "garden", comprising the area between the timber house and the wall, **Mon 1102c**, to the N, and another wall **Mon 1102b**, to the E, was recorded as arable. The occupant of the cottage, **Mon 1069**, may also have kept livestock. The enclosure, **Mon 1068a**, surrounding the cottage and named "plott" was also used for pasture.

In the 1861 Census, after the closure of Eylesbarrow Mine, the "Old Mine House" at "Ailsborough", presumably the Account House, **Mon 1134a**, was occupied by Ann Terrent, described as a "farmer of 7 acres". (WCSL reel 106) Kelly's Directory of Devonshire of 1866 recorded as one of the twelve principal inhabitants of Sheepstor parish, a William Worth, farmer at "Aylsborough". He may have been the occupant of the mine house when it was visited in 1864 by two men on a walking tour. Thus, at Eylesbarrow:

> "we found traces of civilization, for among the ruins lay a cottage of some pretensions. Inside the house we saw the smouldering ashes of a great fire on the hearth, and through an open door caught sight of a small dairy; but the only living creatures we could find in or about the place were two hens! .... so lighting our pipes we lay down on a patch of green grass hard by and rested ourselves for the best part of an hour, when a woman with a baby made her appearance, and shortly after, two men. We now got some delicious milk, and what was perhaps more to the purpose, got information as to our whereabouts." (Butler ed. 1986, 8-9)

In the 1870 edition of Kelly's Directory, George Worth was named as the farmer at "Aylsborough", but, by 1871, the farming enterprise seems to have been abandoned. The Censuses for Sheepstor parish in 1871 and 1881 list one uninhabited house at Eylesbarrow (WCSL reels 151 and 192), while there are no further references to the farm in subsequent Kelly's Directories.

3:5 SUMMARY AND CONCLUSION

Through analysis of the field and documentary evidence, it is possible to suggest a sequence of occupation and land use in UPV. (Summarised in fig. 3:20) There is some evidence to suggest that UPV has been in continuous use for pastoral farming, with occasional arable episodes, since Domesday and possibly even since the Bronze Age. Thus environmental evidence, albeit slight, suggests that sheltered locations including the Plym valley, may have continued to be used for grazing when permanent settlement was abandoned after the Bronze Age. (Beckett 1981, 265) Field monuments relating to this period cannot be isolated from the total archaeological record, though presumably the reaves were still valued as territorial divisions. Shielings such as those attributed by Herring to the pre-Norman period on Bodmin Moor have not been identified in UPV, but some may only be recoverable by excavation while some of the many hut circles could have been re-used. (Herring 1986 cited in Austin, Gerrard and Greeves 1989, 19-20)

The use of the UPV in late Saxon and early Norman times for pasture appurtenant to lowland manors is suggested by evidence, again rather slight, inferred from Domesday Book and later references. Belonging to

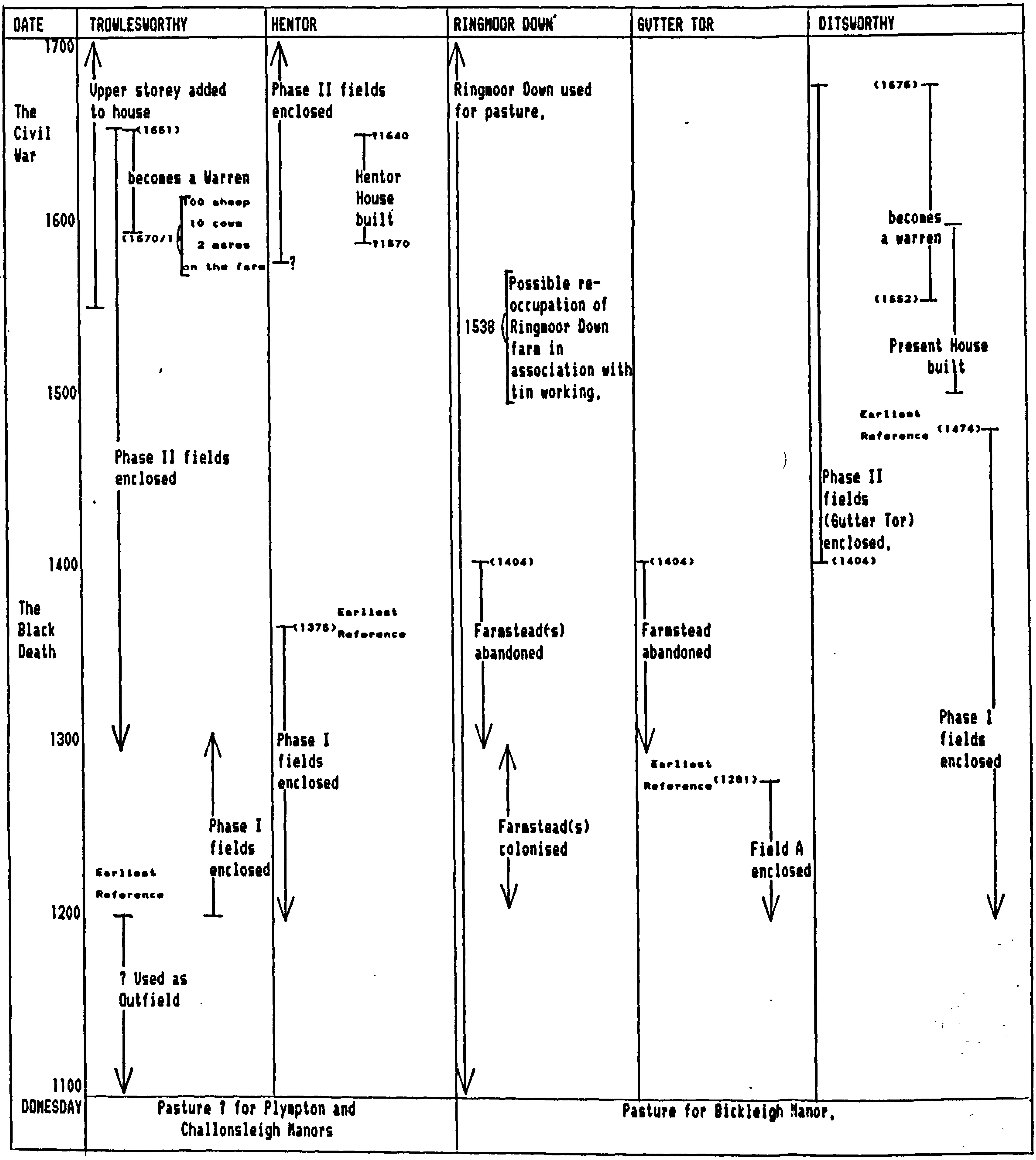


Fig. 3:20 Summary of the sequence of Medieval occupation in UPV

this period are, at least, the corn-ditch and associated drove-way marking the south boundary of the Ringmoor Down and possibly the wall-bank (?originally a hedge bank) defining the west boundary.

Within Ringmoor Down the only subdivision at this time may have been by the Eylesbarrow reave, **Mon 271**. The boundaries which define blocks of pasture seem to depend on, and are therefore contemporary with or later than, the three farmsteads. On the south bank, the hedge-bank, **Mon 479**, built as part of the refurbishment of the Willings Walls Reave, **Mon 540**, which had partly become submerged in bog, could also belong to this early period. It is adjacent to, but not necessarily associated with, Spanish Lake farmstead, and could therefore pre-date the latter, built during a period of reorganisation of pasture.

By the 13th Century the documentary evidence for the UPV is more specific and the first permanent settlement in the upper valley is recorded, at Trowlesworthy and Gutter Tor. Thus UPV experienced a process, repeated all over the South-West: expansion into upland, prompted by population pressure, improvement in climate or, as Austin, Gerrard and Greeves have recently suggested, a "systems change" comprising " a reallocation of the same productive resource within a different legal social and economic framework." (Austin *et al* 1989, 21)

It may be argued that a farmstead called "Rudemor", abandoned before 1404, must also have been colonized in the 13th century. Whether "Rudemor" corresponds with one or all three of the Ringmoor Down farmsteads cannot be determined. However, the layout of the pasture boundaries suggests that these farmsteads are all associated and, therefore, contemporary. Some chronological depth is suggested by the superimposition of arable outfield, **Mon 338**, on pasture, associated with Legis Tor farmstead, and the turf construction of the latter in contrast to the dry-stone of the other two. On present evidence, turf construction is not necessarily earlier than dry-stone, though the use of turf here, rather than dry-stone, may at least suggest a different date for Legis Tor farmstead, from that of Legis Lake and Ringmoor Down farmsteads. Furthermore, the possible contemporaneity between the cultivated fields to the W and E of Ringmoor Down farmstead and the eluvial streamworks, **Mons 343** and **347**, has already been noted. If this streamworking equates with

"Leggers" streamwork, documented in 1538, then the arable episode could date to the 16th century.

However, the streamwork could, of course, have been worked at an earlier date and, even if it was 16th century, the arable could represent a re-occupation of the site, and the pastoral phase of Ringmoor Down farmstead could be much earlier. Thus the three farmsteads could still be broadly contemporary, possibly varying in date only within a generation, consisting of a parent settlement (?Legis Tor) with two later offshoots. All three may, therefore, correspond to "Rudemor", abandoned in the 14th century.

It may be suggested that Ditsworthy and Hentor, first documented in 1474 and 1375 respectively, as well as the undocumented settlements, Spanish Lake, Shavercombe, Shavercombe Foot and Whittenknowles, were also colonized in this phase. However, this is far from certain. Although, on present excavation evidence, longhouse settlements on Dartmoor cannot be dated before the 12th century, not all sites were necessarily colonized in the 12th and 13th centuries.

In the 14th century, UPV witnessed another major change: the desertion of upland settlement triggered by climatic deterioration, crop failures, the Black Death or another "systems change". Gutter Tor and "Rudemor" were presumably victims of one or more of these events and it would be tempting to place the abandonment of the undocumented sites in this phase also. However, this again would be premature; although many sites were deserted in the 14th century, including Gutter Tor and "Rudemor", others, including Trowlesworthy, Ditsworthy and Hentor within UPV, clearly survived. The re-allocation of resources after the 14th century desertion of some holdings may have enabled the remaining settlements to survive. Thus Ditsworthy acquired more fields around Gutter Tor, while pasture, released on Ringmoor Down, was made available to Ditsworthy and other farms, such as Smallacombe, outside UPV.

A fresh impetus to farming in the 16th century may account for the enclosure of the Phase II field system at Hentor and a possible re-occupation of Ringmoor Down farmstead. Greater prosperity and optimism may have prompted the construction of Hentor House and the present

Ditsworthy House, as well as the improvements to, or re-building of, Trowlesworthy House. It is also in this period, that the earliest documents relating to tinworks in UPV appear. (See Appendix D) Although this is not necessarily the earliest tinworking and although the tinworks, which changed hands in the 16th and 17th centuries, were not necessarily worked then, contemporary references to, for example, industrial pollution (see below p.359) suggest considerable tinworking activity on the R Plym at this time. The relationship between tin and agriculture will be discussed further below (see ch. 7) but at this point, it may be useful to record the possible influence of tinworking on the apparent prosperity of 16th century farming.

Another major change occurred in the 17th century, involving the transfer from farming to warrening at both Trowlesworthy and Ditsworthy, prompted perhaps by falling grain and wool prices and competition from farms in more favoured areas.

Thus the sequence of post-prehistoric occupation of UPV may be divided into different phases. Alterations in land use may be attributed to "systems changes" though, on the grounds that systems do not change until they have to, climatic and demographic changes are presumably ultimately responsible. Of particular significance is the recognition, only recently emphasized by Preston-Jones and Rose (1986, 151) and Austin, Gerrard and Greeves (1989, 21), that upland land use depends to a large extent on events in the lowlands; thus understanding the sequence of occupation on lowland sites is "the key to interpreting the phenomenon of upland archaeology." (Austin *et al* 1989, 21)

CHAPTER 4 : RABBIT WARRENS IN THE UPPER PLYM VALLEY.

4.1 INTRODUCTION

A major component of the archaeological record in the UPV is derived from the practice of rabbit-warrening, the breeding of rabbits for commercial profit.

In contrast to the 1950's, when the rabbit was considered to be a serious pest, and to the 1990's, when its principal market is the cat-food industry, the rabbit was once highly esteemed for its meat and fur. In the early centuries of the rabbit's colonization of Britain, its meat was prized as a great delicacy by the nobility. When the population had become well-established and the meat more widely available, it was still highly regarded in humbler circles as a welcome supplement to a largely vegetarian diet.

The former existence of a warren can be indicated by documentary and/or field evidence. The latter, consisting principally of boundary walls, warren lodges, artificial mounds for burrowing, known as pillow mounds, and traps for vermin, demonstrate the presence of six separate warrens in UPV, though some were amalgamated at certain times. (See Fig. 4:1) Documentary evidence suggests that warrening was practised continuously in UPV from at least the 17th century until the 1950's, when the rabbit population was decimated by myxomatosis and finally controlled under legislation.

4.1.1 Physical Characteristics of the Rabbit.

The European wild rabbit, *Oryctolagus cuniculus*, is a small herbivore, which is nocturnal and lives underground in an elaborate system of burrows. Ideally, it inhabits downland with well-drained sandy soil,covered with short grass, adjacent to woodland or scrub for cover; it prefers a Mediterranean climate. (Lockley 1965,130; Tittensor 1986,1)

However it can adapt successfully to less favourable environments. Thus rabbits have been observed burrowing in the hardest loams and heaviest clays and even tunnelling through a coal

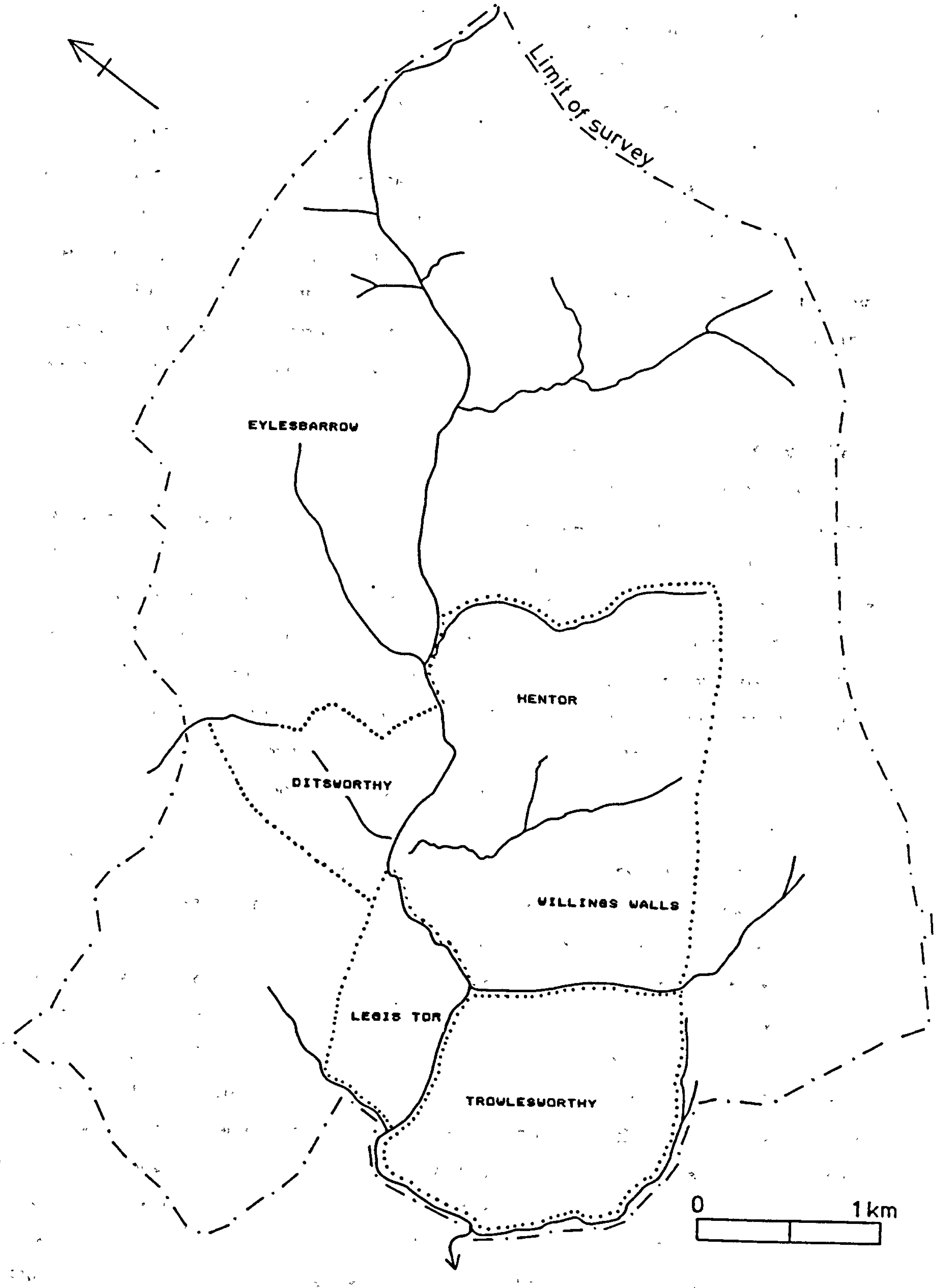


Fig. 4:1 The location of rabbit warrens in UPV

seam. (Simpson 1985, 18) Primarily graminivorous, the rabbit thrives on cereal, hay and silage crops and young tree shoots as well as wild grasses. (Tittensor and Lloyd 1983, 19) It generally avoids "anything woody, spiny, hairy, stinging or poisonous" but in severe conditions, even these are at risk. (Thompson and Worden 1956, 99) Similarly it can withstand a wide range of climate from under 100mm of rain in Australian deserts to the extreme cold of snow-covered plains of northern Europe (Tittensor and Lloyd 1983, 3) or to the heavy rainfall in W Scotland. (Simpson 1895, 24) However, local topography can be critical; burrowing in flat ground can, in times of flooding, cause major losses, particularly among the young in breeding nests. (Simpson 1895, 102; Sheail 1971a, 39)

Uncontrolled, the wild rabbit population can multiply swiftly; the female can start breeding at the age of six or even four months and can produce, in one year, seven litters of an average of five kits. (Tittensor and Lloyd 1983, 9; Thompson and Worden 1956, 57) Thus, in optimum conditions, one doe might produce over 30 young *per annum*. The breeding potential of rabbits may have been exaggerated by some 19th century writers. Thus estimates of the population produced from one pair within four years ranged from a conservative calculation of 478,062 to 1,274,840 (Wilson 1845-6, 442; Bewick 1814 cited in Sheail 1971a, 22) and even to 2,164,800. (Copland cited in Sheail 1971a, 22)

However, absolutely ideal conditions would be required for such a rate of growth and, in the wild, several factors combine to restrict the population. In extreme conditions of weather or over-population, the breeding season can be shortened, the number of young per litter can drop and the doe can re-absorb embryos before birth. (Thompson and Worden 1956, 45,57,112; Tittensor and Lloyd 1983, 9; Lockley 1965, 111) Other factors restrict the number of rabbits reaching maturity. In addition to the threat from predators, the young are also at risk from disease, from occasional neglect by the doe, but, in particular from attack by the buck. This latter risk is minimized by the usual practice by the doe of making a carefully-concealed nest or 'stop' away from her usual residence. (Sheail 1971a, 20) Combined with the effects of severe weather, these controls can reduce the total progeny of one season by 90%. (Tittensor and Lloyd 1983, 10)

However, while the average life expectancy in the wild might be 18 months, rabbits can live to the age of five or six years, or to eight or ten years on islands, where danger from large predators is reduced. (Lockley 1965, 81; Tittensor and Lloyd 1983, 11) Considering that many of the risks can be minimized and many of the advantages, such as fecundity and relative longevity, maximized by careful management, it is not surprising that the rabbit was recognized as a suitable species for farming.

4.1.2 Introduction of the Rabbit to Britain.

The earliest known documentary evidence for the rabbit in Europe is a reference by Polybius in his History, written *c.*204BC, to small burrowing animals, found in Corsica, which resembled, but were distinct from hares. These he called *kunikloi* (after tunnel). (Book 12,3,#10) This early record in the western Mediterranean is apposite as the rabbit is said to have originated in southern France, Iberia and North-West Africa, where its ideal conditions of Mediterranean climate and grass-covered sandy downs are found. (Tittensor 1986, 1) It has been traced back to an ancestor, *Lepus lacosti* in the Upper Pliocene of France. (Barrett-Hamilton 1910-21, 193)

Remains of an ancestral form of rabbit have been found in Britain in Pliocene contexts in Kent's Cavern (Barrett-Hamilton 1910-21, 193) and at Swanscombe (Sutcliffe 1964, 99; Oakley and Gardiner 1964, 118,121, table VId) and on the Mesolithic site of Thatcham. (King 1962, 356) However, this ancestral species did not enjoy a continuous occupation and evolution into the modern rabbit in Britain or North-West Europe, and was almost certainly extinct in Britain by the Roman period. (Tittensor 1986, 2)

The rabbit continued to thrive in SW Europe, becoming such a problem in the Balearic Islands that the inhabitants "sent an embassy to Rome to ask for a new place of abode, for they were being driven out by these animals, because they could not hold out against them on account of their great numbers". (Strabo Book III,2,#6) Rabbit meat came to be regarded by the Romans as a great delicacy and the rabbit was domesticated by the 1st century BC. (Thompson and Worden 1956, 112; Varro Book III,XII,#6)

This esteem for the rabbit might support the theory that the Romans re-introduced it to Britain. The Romans are already credited with the introduction to Britain of edible dormice and frogs. (Lever 1977, 64) Using linguistic evidence, Whitaker may have been the first to propose a Roman origin. (cited in Barrett-Hamilton 1910-21, 184) The English terms 'coney' and 'rabbit' are indeed ultimately derived from Latin, but it is generally accepted that these arrived via France. Thus 'coney' and 'conies' evolved from the plural form *coniz* and *conis* of the Old French *conil* and *connil*. (OED) Similarly, 'rabbit' is derived from the Walloon *rabett*. (Thompson and Worden 1956, 12)

Perhaps more significantly, the British rabbit belongs to the northern sub-species rather than the smaller Mediterranean form, enjoyed by the Romans (Barrett-Hamilton 1910-21, 184), though Fitter claimed that the Romans were responsible for breeding the northern sub-species. (1959 cited in Lever 1977, 63) The argument against Roman introduction is further supported by negative evidence; there are no known archaeological finds of rabbit in Roman contexts in Britain, nor representations in Romano-British art. No rabbits are featured on British coins as in the case of Romano-Spanish coins of Hadrian. (Barrett-Hamilton 1910-21, 182) Finally, the rabbit is not mentioned by Caesar and a suggestion that a reference to hares in De Bello Gallico actually corresponds to rabbits is now generally dismissed. (Sheail 1971a, 17)

Neither is there conclusive evidence from immediately succeeding periods. The apparent presence of rabbit on a Saxon site at Burpham, West Sussex may be misleading; the rubbish pit, containing a lower jaw of rabbit, may have been filled in during the immediately post-Conquest period. (Tittensor 1986, 2) It therefore seems possible that the rabbit was unknown in Britain between the Roman and Norman Conquests.

The re-introduction of the rabbit to Britain is generally attributed to the Normans, which accords with the Old French derivation of 'coney'. This may have occured soon after the Conquest, though the rabbit does not appear in Domesday Book. (Tittensor 1986, 2) Lever (1977, 65) suggests that they were brought by crusaders, returning through Europe in the late 12th century. The limited archaeological evidence supports a 12th century introduction. Rabbit bones were discovered below an early 12th century potsherd at Buttermarket, Ipswich. (Tittensor 1986, 2) Other rabbit remains from a midden at Rayleigh Castle, Essex may date to the late 12th century or the first two decades of the 13th century. (Veale 1957, 86-7)

Documentary evidence is more specific. The earliest known reference to rabbits in Britain is a document dated 1176, in which Richard de Vyka, constable of the Scilly Isles, granted, to the Abbey of Tavistock, his tithe "*de cuniculis*". (Finberg 1969b, 97) Another early reference demonstrates the presence of rabbits on Lundy Island, off the N Devon coast; at some date between 1183 and 1219 the tenant was entitled to take 50 rabbits a year from certain "*chovis*" (?coves) on the island. (cited in Veale 1957, 86) Emphasis on islands continues into 13th century documents with a reference in 1225 to a *"custod' cunicularium"* in the Isle of Wight in the manor of Bowcombe, Carisbrooke, held by the Earls of Devon. (Veale 1957, 86) A final reference from the 12th century comes from a discussion on the hare in Ireland, written 1183-86 by Giraldus Cambrensis, in which it is described as similar to the rabbit. (ed. 1982, 48) Although Fitter (cited in Lever 1977, 68) suggests that Giraldus may have seen rabbits on a visit to Paris in 1167, his casual reference indicates a familiarity among the author and his readers.

From these references it might be concluded that an important role was played by SW England, and Devon in particular, in the inception of Medieval rabbit colonization. However, accidents of documentary survival may be a factor in the preponderance of early evidence from the South-West.

Initially the rabbit population was concentrated in isolated pockets and its distribution corresponded with that of warrens. (see below section 4.1.5) However, gradually escapees filled in the gaps and the benefits accruing to the resulting feral population from agricultural improvements probably led to the dramatic increase of rabbit numbers in the 19th and 20th centuries. This increase will be discussed with the decline of warrens (see section 4.5), while the early history of rabbit colonization corresponds to the development of warrens.(see section 4.1.4)

4.1.3 Definition of Warren.

Before discussing the development of warrens, it is first necessary to define the term. The modern definition of a complex system of burrows, excavated and occupied by rabbits, is not relevant here.

Otherwise, "warren" can be applied to a rabbit farm, in which rabbits were bred primarily for a supply of meat and fur. These may be termed "domestic", where this supply was princially for home consumption or "commercial", where the produce was sold for profit. Both may be distinguished from "game warrens", in which the principal interest was sport. In this category, a further distinction may be made between enclosed sporting warrens, which mostly date to the 19th and 20th centuries, and the right of "free warren", in which sporting privileges over particular species in a defined, but not necessarily enclosed area, were granted by the king from Medieval times.

Apart from the small-scale enterprise at Eylesbarrow, the UPV warrens were all operated on a commercial basis. However, they co-existed on Dartmoor with other warrens, which had primarily a sporting function and it seems that the distinction originated at an early stage of the rabbit's colonization.

It might be argued that there was, at first, no clear division between domestic/commercial warrens and game warrens. Thus the prey of the game warren could still be used to stock the larder, while occasional sport could be enjoyed on a domestic or commercial warren. However, a distinction can still be made between the two types. Thus, in a charter of *c.* 1317, William de Breos, Lord of Gower, granted to his huntsman the right to hunt hares, foxes and rabbits and other animals and birds throughout his warren except "in his cuniculary of Pennarth [Pennard] in the sand burrows." (RCAHMW 1982, 323) RCAHMW conclude that the cuniculary was "a specially tended enclave, probably against the foxes of the warren, where from time to time the lord reserved the rabbiting for himself." (*ibid.*) However, it may be suggested that the distinction drawn in this document corresponds to the distinction between the game warren and the domestic warren, and de Breos was, therefore, protecting his meat supply.

Other references, to payments given for catching rabbits must surely preclude hunting on some warrens. Thus Richard-le-Forester was paid 3s 6d in 1282 for catching rabbits for the king and for keeping the king's ferrets at Rhuddlan Castle, Flintshire (Clwyd) (Barrett-Hamilton 1910-21, 185) Similarly three ferreters were paid 12s 3d in 1325-6 for catching rabbits on the islands of Skomer, Skokholm and Middleholm off the Pembrokeshire coast. (cited in Matheson 1941, 373) Further in 1329, David II of Scotland's chamberlain paid 8s to four men for catching rabbits on the Isle of May in the Firth of Forth. (Lever 1977, 69)

4.1.4 <u>Development of Commercial Warrens.</u>

The earliest reference to a rabbit warren dates to 1241, when Henry III ordered hay to be carted from his *cuningera* at Guildford. (Veale 1957, 88) Rabbit warrens may not have been long established; thus from 1226 onwards, orders from Henry III appear in Liberate Rolls for venison, boars, fish, swans, peacocks, hens, eggs and hares for feasts, but not until 1240 are rabbits included. Furthermore, these were only ordered from three sources, while total orders for provisions were sent to 16 suppliers. Thus 100 rabbits were requested from the bishopric of Winchester and 200 each from the Earl of Warenne and from the king's escheator.(*ibid.*) Further orders from the king for the supply of rabbits, varying in numbers from 50 to 500, were issued in the remaining years of the decade.(*ibid.*)

Despite these large numbers of rabbits furnished for feasts, the rabbit population was probably still at an incipient stage of colonization and warrens were being stocked from a limited number of widespread sources. Veale suggests that the period between 1230 and 1250 was critical in the development of warrens; this is illustrated by the record of the exchange of live rabbits between different parts of the country.(*ibid.*) Thus in 1241, 100 live rabbits were to be sent from the bishopric of Winchester to Sugwas, manor of the bishop of Hereford. In the same year, 80 live rabbits were sent from Clacton, Essex by the bishopric of London to a warren at Cheshunt, owned by Peter of Savoy. By 1244, the king's park at Windsor was stocked from Guildford, Stamford and the bishopric of Surrey.(*op. cit.*, 89)

Gradually the warren population was secured and documentary evidence from succeeding centuries demonstrates the formation of new warrens all over the country. Thus *cunicularia* are mentioned in the law book Fleta in 1290, (Barrett-Hamilton 1910-21, 185) and *conynges*, warrens and *connigeries* made their first appearance in the Statute Book in 1389.(*op.cit.*, 186) Furthermore, while the earliest warrens may have served a primarily domestic purpose, even if on the grand scale of royal households, gradually the economic potential was recognized, giving rise to the true commercial warrens. References to the profit motive appear; for example, in 1475, a "warander of kunynyare" for Cupar Abbey promised to maintain the "conygar from all harm ... and put it to all profit within his power." (quoted in Lever 1977, 70)

In 14th and 15th centuries, rabbits remained on the bill of fare at important feasts, and in ever-increasing numbers. A feast given for Richard II by the Bishop of Durham in 1386 included 400 conies. (Barrett-Hamilton 1910-21, 185)) Rabbits also featured in banquets to celebrate the coronation of Henry IV in 1399 and the installation of the Archbishop of Canterbury in 1443, while in 1465 4000 "conyes" were served at the installation of George Nevill, Archbishop of York. (*op. cit.*, 187)

In the 13th and 14th centuries variation in prices may reflect local variations in supply, and rabbits, while still restricted to isolated warrens, may not have been easily obtainable everywhere. Thus in 1270 a rabbit cost 5d on a Cambridge estate. (cited in Veale 1957, 89) At a cost of 6d each rabbits ranked in price with *porcellus* (?suckling pig) in the shopping list for the installation feast of Ralph de Borne, Abbot of St. Austin's Abbey, Canterbury in 1309. (Barrett-Hamilton 1910-21, 185) Yet, in 1272 rabbits fetched only 2½d each at Waleton, while this same price held between 1253 and 1376 at Farnham, Surrey. (Lever 1977, 69) Moreover, in 1395, the need to buy 20 couples at between 6d and 8d a pair at Bushey, Herts. and transport them at a cost of ½d each for a feast at Merton College, Oxford suggests the lack of a local source. (Veale 1957, 89) However, a gradual levelling in price may indicate increasing availability. The price dropped to 2d each in 1413-14 and this remained relatively steady for a century; in 1530 rabbits sold in Yorkshire for 5d a couple. (Barrett-Hamilton 1910-21, 187) The increase after 1540 to 7 3/4d a couple may still fit the pattern of greater availability as the rise was comparatively small in a time of general inflation.(Veale 1957, 90) The abundance of rabbits in England in mid-16th century was observed by the Swiss naturalist, Gesner (Veale 1957, 90) and by the 1690's the rabbit population in England was estimated at one million. (Sheail 1971a, 87)

At this point it might be appropriate to consider how and why the rabbit warrens spread so successfully. The arrival of warrening with rabbits is attributed to the Normans but it might be possible to pinpoint a particular social group. An important factor must have been a connection with Continental Europe and strong continental links were enjoyed by the church and specifically the upper clergy and monastic brethren. Early participation of the clerical hierarchy is demonstrated by mid-13th century references to the maintenance of coneygarths by the archbishop of Canterbury and the bishops of Winchester, Chichester and Hereford.

While such influential individuals could have contributed to the success and spread of warrening, greater consolidation may have been effected by institutions as a whole. Monastic orders, which favoured isolated and dispersed locations could be considered to be ideal agents for the distribution of warrens throughout the country. Further, the keeping of a warren accords with the pastoral pursuits adopted by the monastic orders. Rabbit-rearing could have been assimilated readily into a system already operating dovecotes, fishponds and sheep farms. Game preserves also seem to have been accomodated into these pastoral activities. Thus, at some stage, Tavistock Abbey held on Deerpark Hill, between Taviton and Whitham, a deer park, while the hunting exploits of the monks in the 14th century when Abbot John de Courtenay kept a pack of staghounds demonstrates a certain taste for sport. (Finberg 1969a, 192-3) However, on the whole and particularly in the earlier centuries, the rabbit may have been excluded from the chase. The *cunicularium* held by the Prior of Ely in the Breckland in 1300 was presumably separate from any game preserve. (Sheail 1978, 343) In Dolvin Wood, below Tavistock Abbey's deer park was a rabbit warren, which was always retained when the rest of the hill was rented out. (Finberg 1969a, 192) This suggests that the rabbit was held in high regard by the monks and may have been a major food supply.

However, a greater role may have been played by the Cistercian Order. The emphasis placed on industry and piety by the Cistercians may have precluded participation in the hunting enjoyed by the Benedictines of Tavistock, but it would not necessarily have prevented the keeping of a warren. The preference for working their own land should not have been a major obstacle; lay brethren could easily have operated a warren in a similar way to their sheep farms. Furthermore, it may not be purely accidental that the 12th century dispersal of the rabbit coincides with the expansion in Britain of the Cistercian order after its foundation in 1098.

The connection between the N bank of UPV and Buckland Abbey has already been discussed and it would be tempting to attribute the introduction of warrening in UPV to the Abbey. However, there is no evidence for warrening at Ditsworthy before the 17th century, though a reference to a *'conyger'* in a list of Buckland property may indicate a rabbit warren somewhere in the Abbey's lands. (Brooking Rowe 1876, 801)

However, religious houses alone may not have accounted for the spread of rabbits and warrens. Royal and aristocratic patronage may also have contributed, in the provision of feasts, such as those already noted and in a penchant for rabbit fur. The practice in the Medieval period of lining gowns with fur, provided warmth and allowed display of wealth. The finest furs were sought but, to maintain exclusivity, the quality of fur used was strictly controlled. Thus by a statute of 1337 only the nobility, specified as "the royal family, prelates, earls, barons, knights and clerks with at least £100 a year" could wear fur at all. (Veale 1966, 4-5) Later statutes restricted the more prestigious imported skins to the nobility while native furs could be worn by anyone. Prior to the rabbit's colonization of Britain, it would have been highly esteemed as an imported fur, though possibly one of the cheaper imports. Thus, in 1237, 6,000 rabbit skins were seized from Spanish and French merchants, and in 1244 a Lisbon merchant sold rabbit skins worth £27 12s 6d to the royal tailor at Winchester fair. (Veale 1966, 68) King John went to considerable expense to procure fashionable furs. Reserving ermine, squirrel and otter for himself, he still acquired imports for his liveries. He paid £1 each for northern squirrel linings, 8s to 10s for rabbit linings and 6s to 7s for lambskin linings compared to £5 each for ermine linings. A patronage of warrening by royalty and aristocracy in the 12th and 13th centuries could have been conducted in an endeavour to produce rabbit fur, though the fairly rapid establishment of a native rabbit population resulted in a decrease in value and prestige.

Thus it may be concluded that several agencies, principally the clergy and nobility, contributed to the introduction and spread of warrens. After their introduction, warrens were maintained through succeeding centuries until their decline in the 19th century, though some warrens, notably those of the UPV, continued in operation until the mid-20th century.

The development of warrens seems to follow a dual-phase pattern; the 12th or 13th century formation of warrens, which entailed a slow, expensive accumulation of breeding colonies was succeeded by a fresh impetus in 17th and early 18th centuries. (Sheail 1978, 347) A decline in grain prices from 1660 to 1750 coupled with a downward trend in wool prices throughout the 17th century prompted a two-fold response. Farmers with fertile well-drained soils increased fertility and productivity by introducing new crops, such as legumes and root crops into their rotations, and new technology, such as irrigation. At the same time farmers with poorer land were impelled into a greater reliance on the rabbit. However, they also benefited from the land improvements as the new crops provided sufficient winter fodder for livestock and allowed hay, previously reserved for sheep, to be released to rabbit warreners. (*op.cit.*, 348-9) Rackham also suggests (1986, 47-8) that, by the 17th century, rabbits were better adapted to British conditions. Steady demand for rabbit meat probably favoured warrening, as did the increasing reliance on locally-produced fur, particularly rabbit, after 16th century inflation largely restricted imported furs to a very small minority. (Veale 1966, 176) Many may have been encouraged by a belief, later shown to be mistaken (see below p.333), in the great benefits conferred by rabbits. The damage caused by an over-abundance of rabbits was concealed by the common practice of grazing sheep with rabbits in an integrated farming system. This prompted an agricultural commentator from Bawtry, Yorks. to claim in the 1650's that a new warren

> "will keepe the same stock of cattle or sheepe (within a trifle) which they were wont to doe formerly though well stocket with coneyes". (quoted in Sheail 1978, 348)

The warrens in UPV, which, as will be demonstrated below, seem to have originated in the 17th century, may, therefore, be products of this second phase of expansion.

4.1.5 Distribution. The distribution of warrens can be ascertained through documentary sources and material remains. Place-names can also indicate the former existence of a warren. Sheail's map illustrates the distribution in England of place-names containing the element 'warren' (1971a, 36-37 Fig.4), though the separate definitions of the term 'warren' should be remembered. Otherwise a suffix 'bury' in a place-name, which in S.Devon, includes Wembury, Bigbury and Modbury, might be a guide but can be ambiguous. The root *burh* can refer to earthworks of any kind, including castles and camps as well as pillow mounds or buries. (Gover, Mawer and Stenton 1932, 675) Similarly names, such as Coniger or Coney can be useful but with reservations. Thus Conies Down in the Cowsic valley, Dartmoor is almost certainly identified with Condyshull, which may be derived from the root *cunet*, meaning hill, though the spelling of 'conies' may be a result of familiarity with warrening.(*op.cit.*,193)

Another of Sheail's maps was compiled from a study of the Board of Agriculture County Reports. (1971a, 88 Fig.10) Written between 1794 and 1815, these may coincide with a peak in warrening before the 19th century decline. This map demonstrates the widespread distribution of warrens throughout Britain, though cannot be considered comprehensive; the single warren listed for Dartmoor is patently an underestimate. However, the map indicates the importance of the local environment in producing this distribution. Warrens seem to be concentrated in four types of habitat.

Thus there is a significant number on islands and adjacent littorals, where the earliest documented colonies were located. A major concentration is focussed on areas of light, dry sandy soils, such as the eastern counties of Norfolk, Suffolk, Lincolnshire and Nottinghamshire as well as sandy parts of Hampshire and Kent. In the eastern counties in particular, huge tracts of land were increasingly devoted to rabbits in the late Medieval period. (Sheail 1971a, 89) Thus by the early 19th century, warrens occupied 11% of the Breckland, while in 1800 one landlord owned between 3,000 and 4,000 acres of warrens in Lincoln Heath.

(*op.cit.*, 89-90) Warrens are also numerous on calcareous grasslands, notably the Yorkshire Wolds, where in 1808, there were 20 warrens covering 10,000 acres in the East Riding alone, and Wiltshire, where Aldbourne Chase was renowned. (*op.cit.*, 90-1) Finally, a significant number of warrens are found on moorland, notably the North Yorkshire Moors, particularly Pickering and High and Low Dalby. (*ibid*) and Dartmoor.

4.1.6 Dartmoor Warrens

On Dartmoor, 25 warrens as well as 2 isolated buries have been recorded from documentary and/or field evidence. (see Table 4:1) Some consist of only a few pillow mounds associated with farms and these may have been developed to supplement farm income. Thus the buries at Zeal and Yalland farms, South Brent were probably, as Haynes suggests, 19th Century enterprises worked in conjunction with farming, though Linehan raises the possibility of earlier origins at Yalland because of its proximity to ruined longhouses. (Haynes 1970, 104; Linehan 1966, 141) Haynes also suggests that the success of Headland Warren encouraged the introduction of warrening on the adjacent farms of Soussons and Challacombe, Manaton. (Haynes MS) Warrening is documented at Soussons from 1842 until the early 20th century, though no corroborative evidence has been found for Challacombe. (Hemery 1983, 620; Le Messurier 1966, 61) No pillow mounds have been recorded at either warren though afforestation may have destroyed any material remains at Soussons, while as Haynes suggests, casual marketing of rabbits may have been possible without great efforts at breeding. (Haynes MS)

Other warrens seem to have been established specifically to provide a food supply for a particular market. Thus the pillow mounds alongside the Redlake/Leftlake clayworks tramway were built for the benefit of the clayworkers when work re-commenced there at the beginning of the 20th century. (Linehan 1966, 142) They may have been provided to forestall a repetition of raids by Redlake turf-cutters on Huntingdon Warren in the 19th Century. (Crossing, 1912, 372) Similarly three pillow mounds at Eylesbarrow, **Mons 1106, 1126 and 1144**, and possibly a third further W, **Mon 806** may have been built to supply Eylesbarrow Mine in the early 19th Century, if not earlier tinworks in the area. Furthermore, Fleming and

Table 4:1 Table of Dartmoor Warrens.

WARREN NAME and Parish	DATE	PILLOW MOUNDS	VERMIN TRAPS	FUNCTION	GRID REF.
TROWLESWORTHY Shaugh Prior	Mid 17th. Cent.	55	31	Commercial	SX 574 645
WILLINGS WALLS Shaugh Prior	1807	11	2	Commercial	SX 585 650
HENTOR, Shaugh Prior	1807	35	4	Commercial	SX 590 656
LEGIS TOR, Sheepstor	At least 1718	45	8	Commercial	SX 572 655
DITSWORTHY, Sheepstor	Mid 17th. Cent.	48	8(+Coverstone)	Commercial	SX 585 663
EYLESBARROW, Sheepstor	Early 19th. Cent	6 (+ 4 bases)	-	Tin Mining later Commercial	SX 598 682
MAIDEN TOR, Sheepstor	Early 19th. Cent.]]-	6 (ref 5 p161-162 and ref 7 table III)	-	Sporting	SX 562 681
SHEEPSTOR, Sheepstor	18th. Cent.]		3(ref5 p161-2)	?Commercial	SX 563 683
REDLAKE TRAMWAY, Ugborough	Early 20th. Cent.	>6 (ref 7 tableIII)	-	Clay Works	SX 654 594
WEST ROOK GATE, Cornwood	?	1 (ref 5 p164)	-	?Farm or Sport	SX 603 613
UPPER NEWLEY COMBE, Walkhampton	?	1 (ref 5 p164)	-	?Farming	SX 596 698
ZEAL(BURROWS), South Brent	Probably 19th. Cent.	4 (ref 7 table III)	-	Farming	SX 679 630
YALLAND, South Brent	Probably 19th. Cent.	6 (ref 7 table III)	-	Farming	SX 688 633
HUNTINGDON, Lydford	18th. Cent.	20 (ref 7 table III) 80 (ref 1:5 p163)	4 (ref5 p163)	Commercial	SX 660 670
VAGHILL, Widecombe-in-the-Moor	At least 1613	23 (ref 7 table III) 25 (ref 5 p163-4) 30 (ref 1)	3 (ref5 p163-4)	Commercial	SX 680 725
ROUND HILL, Lydford.	?	2 (ref 1)	-	?Farm or Sport	SX 617 742
WISTMAN'S WOOD, Lydford	1895	12 (ref 7 table III)	-	Sporting	SX 613 774
CROCKERN, Lydford	Late 19th. Cent.	3 (ref 1)	-	Sporting	SX 611 757
BEARDOWN, Lydford	? late 18th. Cent.	25 (ref 7 table III) 32 (ref 2) 22 (ref 1)	-	?Sporting	SX 600 754
MERRIVALE/MIS TOR Walkhampton	? Late 18th. Cent.	12 (ref 7 table III) 14 (ref 1)	-	?Sporting	SX 600 754
HEADLAND, North Bovey	At least 1780	8 + Tinners'heaps (ref 5 p162-3)	4 or 5(ref 3 ref 8)	Commercial	SX 685 814
NEW HOUSE, Lydford	At least 1831	- Tinners'heaps	-	Warren House Inn	SX 674 809
SOUSSONS, Manaton	1842 (ref5 p164) 18th. Cent(ref6 620)	- Destroyed by - Afforestation	-	Farming	SX 686 792
CHALLACOMBE, Manaton	19th. Cent	-	-	Farming	SX 694 795
GIDLEIGH CHASE, Gidleigh	?	-	-	Sporting	SX 673 877
SKAIGH, South Taunton	Probably 19th. Cent.	17 (ref 7 table III) 19 (ref 1)	-	Sporting	SX 630 935
HOLNE.	?	7 (ref 4 p127)	-	Tin Mining	SX 680 710

REFERENCES

1. O.S. Map 1:25,000
2. Haynes M.S.
3. Brewer, 1986 b.
4. Fleming and Ralph, 1982.
5. Haynes, 1970.
6. Hemery, 1983.
7. Linehan, 1966.
8. Woods, 1986.

Ralph suggest that seven pillow mounds on Holne Moor may have been associated with tin mining. (1982, 127) The duration of these warrens may sometimes have depended on the success of the relevant industries. Thus the pillow mounds at Redlake may only have been worked for the 20 or so years of the life of the clay works. (Linehan 1966, 142) However at Eylesbarrow, the pillow mounds were adopted by Ditsworthy Warren after the mine closed.

New House Warren, Lydford was also, according to Hemery, created to supply a particular market, namely New House Inn, a forerunner of the Warren House Inn beside the main trans-moorland road (now the B3212). (Hemery 1983, 507)

Sporting warrens again mostly dating to the 19th Century comprise another important group on Dartmoor. Thus Wistman's Wood Warren, Lydford was rented for he purpose of sporting by the resident at Powder Mills, named Mr Jones Saltoun by Crossing (Le Messurier 1966, 61) and Mr James Saltroun by Hemery (1983, 455). Here the pillow mounds and a wooden gamekeeper's cabin were constructed in 1895, though the enterprise seems to have folded before the First World War. (Hemery 1983, 456) The three pillow mounds at Crockern Tor, S of Wistman's Wood were constructed for the same man and presumably for the same purpose. (Hemery 1983, 457) Again, Haynes recorded information from the warrener at Trowlesworthy, that pillow mounds at Sheepstor were built by the Plymouth Corporation after the completion of Burrator Reservoir (opened 1898) with the intention of letting shooting. (1970, 161) Haynes' difficulty of reconciling a turn of the century date with the existence of vermin traps is by-passed by Hemery's division of the material remains into two groups. (*ibid.*, Hemery 1983, 160) Therefore the pillow mounds in the vicinity of Maiden Tor, mostly with exposed stonework and with a modern appearance may be attributed to a 20th century sporting enterprise, separate from the entirely grassed-over buries and vermin traps of an older warren uphill. Skaigh Warren, South Tawton, Beardown Warren, Lydford and Merrivale Warren, Walkhampton, may also have been sporting warrens, though the latter two may be a little earlier than the other sporting warrens, with 18th Century origins. Beardown Warren was referred to in a 1868 lease of a neighbouring property (Hemery 1983, 297) while pillow mounds at Merrivale were constructed by the builder of a cottage, which was in ruins by 1832. (Haynes MS)

Gidleigh Chase may also have belonged to this group, though the only evidence is Crossing's assertion that "there was anciently one" there. (Le Messurier 1966, 57) The Chase, originally much larger than the presently forested area was undoubtedly a hunting ground of Gidleigh Manor. (Crossing 1986, 21) While primarily a deer chase, beasts of the warren, including rabbits, may have been hunted as well, though there is no record of pillow mounds.

However the oldest and longest-lasting warrens with the greatest amount of field and documentary evidence belong to the last and probably the most important group, the commercial warrens. This group consists of the five main UPV warrens: Trowlesworthy, Willings Walls, Hentor, Legis Tor and Ditsworthy (discussed below) as well as Vaghill Warren, Widecombe-in-the-Moor, Headland Warren, North Bovey, and Huntingdon Warren, Lydford. A 13th Century origin is frequently attributed to Trowlesworthy, but evidence discussed in detail below (p.254) suggests that Trowlesworthy did not become a warren until the mid-17th Century, at about the same time as Ditsworthy.

Therefore Vaghill, documented in 1613, is the oldest recorded warren on Dartmoor. In that year, William, Earl of Bath, leased to Richard Reynell and Walter Fursland of Buckington:

> "Waste ground called Spitchwick common lying between the river Darte on the west and south east and from thence to Heartor (Yartor) on the north and from Heartor to Cornetor (Corndon Tor) on the north and east to the west of Rowbrook hedge and so on to Logator on the east and so to the river of Darte with free liberty to make a warren there for the keeping breeding and killing of rabbits."
> (quoted in French and Linehan 1963, 74)

Headland Warren dates at least to 1780 when William Roberts was described in the Land Tax List as a Warrener. (Hemery 1983, 643) He was succeeded at some time before 1818 by his son Thomas and later by his grandson, John. It was the latter who opened the warren house as the Birch Tor Inn to take advantage of the mining population. (*ibid.*) In the mid-19th Century began the occupancy of the Hannaford family, which continued over three generations, during which time Headland took over the operation of Vaghill Warren.

Huntingdon Warren may also date to the 18th Century. A lease, dated 1809, granted land already enclosed called Huntingdon Warren, together with another parcel of land, to be enclosed within ten years. (quoted in Hemery 1983, 310) Thus the enclosure wall running from Buckland Ford on the R. Avon to Higher Huntingdon Corner may relate to the 1809 enlargement, while an earlier warren may have been enclosed by the wall running between Broad falls on the R. Avon and Gibby Beam on W. Wellabrook. (?Lower Huntingdon Corner) (OS Map 1:25,000) Warrening seems to have continued through the 19th Century, but ceased, according to Hemery, after the First World War, though Crossing claimed that at the time of his writing (1903), Huntingdon was let to the Dartmoor Hunt. (Hemery 1983, 311; Le Messurier 1966, 60)

Sheepstor Warren, though small may have been a commercial enterprise and may date to the earlier part of the 18th Century. The vermin traps were out of use and turfed over by 1802 when the Rev. Bray encountered them. (1838, 234) Finally some warrens are difficult to place in any category. The two pillow mounds at Round Hill Farm, Lydford and the single pillow mounds at West Rook Gate, Walkhampton and Upper Newleycombe, Cornwood, may all have been associated with farming, though Rendell suggests that the former two are sporting warrens associated with Prince Hall and Rook Manor House respectively. (1990, 6)

4.2 DOCUMENTARY EVIDENCE

4.2.1 Introduction

The series of title deeds for Trowlesworthy, already referred to in chapter three, continues until 1792, thereby covering the earlier part of the period of warrening at Trowlesworthy. (WDRO 710/15 - 710/23; 710/126a and b)

Detailed leases also survive for Ditsworthy and Hentor warrens. (WDRO 70/189; DRO PZ11; WDRO 582/11/2) A history of the occupation of Ditsworthy and Legis Tor Warrens in the 18th and 19th Centuries can be traced through the church wardens' accounts of Sheepstor Parish. (DRO PW1, PW2) These account books dating from 1718 list parish expenses, and, more significantly record the rate levied on the residents of the parish for the maintenance of the church. Thus for each year in which a rate is charged, the person responsible for payment on each property, is named.

In the 19th Century other sources of information are available for all the UPV warrrens. Census returns collected every ten years from 1841 record all the inhabitants of each house (PCL HO107, RG9, RG10, RG11; WCSL reel 12, 64, 106, 151, 192) while the Tithe Map and Apportionment of 1840-3, records landowners and occupiers as well as details of houses and enclosures (WDRO 144/2/8, MFC 710-713; MFC 717-718; DSMR). County directories such as Kelly's list principal estates, including warrens, and their occupants.

Finally from the end of the 19th Century, detailed information on the management and operation of warrens was recorded by writers who were personally acquainted with the warreners, notably Worth (1889-1900), Crossing (Le Messurier 1966), Haynes (MS and 1970) and Hemery (1983).

4.2.2 The UPV Warrens.

a) Trowlesworthy

It has frequently been claimed that Trowlesworthy was a warren by 1272. (Crossing 1912, 431; Havinden and Wilkinson 1970, 173; Haynes 1970, 156; Hemery 1983, 221; Brewer 1986a, 51; Rendell 1989, 13; 1990, 4) The only source for this claim seems to be the statement in the 1811 Additions to Risdon's Chorographical Survey ... of Devon, that:

> "Troulsworthy Warren in the parish of Shaugh was granted before date of deeds, by Baldwin de Rivers, Earl of Devon to Sampson de Traylesworthy, at some period between the year 1135 and 1272." (1811 ed, 392-3)

It may be assumed that Risdon's editor was referring to the earliest in the series of title deeds for Trowlesworthy, which, as suggested above, must have been issued between 1107 and 1262. (see p.181) However, there is no reference to a warren in this deed; Sampson de Traylesworthy is simply granted "all the land of Traylyswurthy". (WDRO 710/1) Nor is warrening mentioned in any of the deeds until a lease issued in 1651.

(WDRO 710/15) Moreover, positive evidence that, prior to the 17th Century, farming rather than warrening was practised at Trowlesworthy is provided by William Woollcombe's bequest in 1570/1 of 100 sheep, 10 cows and 2 mare colts "all at Trowlesworthy" to his son Baldwyn, to whom Trowlesworthy had already been granted. (see above p.191; WDRO 710/751)

Therefore it seems most likely that Risdon's editor was simply using the title of the property as it was known in the 19th Century and that the suffix "warren" was not in use at the time of the original grant.

Rather, the title deeds suggest that warrening was not introduced to Trowlesworthy until the 17th Century. The first reference to a warren appears in a lease issued in 1651 by William Wollcombe of Challonsleigh to a skinner from Plymouth named John Hamblin. (WDRO 710/15) This granted "All that Messuage and Tenement ... called ... Tralesworthy als Troleswortbie ... now in the tenure or occupacion of one John Meade ..." to be "used occupied possessed or enioyed either as a warren or otherwise". (*ibid.*) This last phrase suggests that warrening is not fully established and perhaps a relatively new enterprise, possibly introduced by the previous tenant John Meade and now to be exploited by a skinner.

It may be no coincidence that the first reference to warrening at Ditsworthy is also associated with the name of Meade (see below p.260) and it is tempting to attribute the introduction of warrening to UPV to a single family. The beginning of warrening in UPV would then belong to the 17th Century expansion described above. (see p.248)

The bounds of Trowlesworthy in 1651 remained as they were in the 13th Century. The property was leased for a consideration of £460 and an annual rent of £3, for 99 years or the lives of John Hamblin's son, John, Richard Pinsert and Johane Burchill. A heriot or farleu of £3 was to be paid after their deaths but not on the deaths of Richard Pinsert or Johane Burchill if John Hamblin, Junior was still alive or on the death of Johane if Richard Pinsert was still alive. The lease also granted "comon of pasture Turbarie furse and heath in and upon Leigh Moore and Comons of Estover (FN 1) houseboote and foldboote in Bickley Wood." Hamblin was required to maintain the premises, including "houses hedges ditches gates and fences" and, for such purposes, was allowed to take "great timber" growing on the property as well as "houseboote hedgeboote fireboote foldboote ploughbote frith (FN 2) and stakes."

It is possible that John Meade continued to live at Trowlesworthy working as a warrener for John Hamblin, the skinner, as the Meade family was still connected with the warren over 30 years later. Thus "John Meade Junior", presumably his son, was the tenant of Trowlesworthy in 1685 (WDRO 710/18) and described as a "warriner" in a lease of 1695 (WDRO 710/19).

In 1675 Honor Woolcombe, who had inherited Trowlesworthy, from her father William, sold the property to her brother, also William, for £310. (WDRO 710/16a and b) By this time Trowlesworthy was in the tenure of Johane Burchill and John Elford under a 99 year lease for an annual rent of £3, but again, John Meade, Senior or Junior, may have been employed as a warrener. Warrening had become an established practice at Trowlesworthy; thus warrens are included in the list of assets included in the sale: "All those messuages houses edifices buildings lands tenements warrens woods underwoods and hereditatments ... called ... Trollsworthy als Troulsworthy als Traylesworthy". (WDRO 710/16)

Possibly to strengthen her brother's title, Honor then specifically renounces her claim to Trowlesworthy and other properties and to the rent from Trowlesworthy in a quitclaim of 1675. (WDRO 710/17) In 1685 William Woolcombe mortgaged the property for £150 to Henry Woolcombe of Ashbury. (WDRO 710/18). By then, as noted above, Trowlesworthy was in the tenure of John Meade, Junior.

By 1695, John Meade, "warriner", had died and Trowlesworthy was leased by William Woolcombe to Roger Phillip, a maltster from Plymouth.

FN 1 Comons of Estover = right to take wood.
FN 2 frith = brushwood

(WDRO 710/19) The lease was granted for a sum of £400 and an annual rent of £3, for the term of 99 years or the lives of Roger Phillip, Margarett his wife and William Warne of Ham. A heriot of £3 was payable after their deaths but not on the death of Margarett if Roger was living or on the death of William Warne if either Roger or Margarett was living. This time the property was let "together with all the rabetts and coneys now on the said tenement or belonging thereto". The lessee was, as usual required to maintain the property and was permitted to take sufficient wood for repairs. In addition Roger Phillip was allowed "to cutt faggots and turfs for making of blackwood on the usuall places of the said tenement". (*ibid.*) These "usuall places" may refer to the peat cuttings to the W of wall, **Mon** 7 and marked on the 1842 "Rough Plan of Trolsworthy". (WDRO 710/203) (see Sheets 1 and 7)

By 1746 Trowlesworthy had acquired the suffix with which it is known today. In that year, John Woollcombe of Plympton St Mary leased to Richard Lillicrap the Younger "All that Messuage or Tenement and Warren thereunto belonging commonly called or known by the Name of Trolesworthy otherwise Troulsworthy Warren". (WDRO 710/20) Richard Lillicrap had already been the tenant "for severall years" and in 1746 contracted to lease it for a further seven years for an annual rent of £50. He was required to maintain the "walls hedges gates and fences" and at the end of the lease, leave the latter in good repair "Together with a full stock of Rabbits in the said warren." (*ibid.*)

The remaining deeds in the Trowlesworthy series concerns the transfer of the property among members of the Woollcombe family in Deeds of Common Recovery (WDRO 710/21a and b; 710/22) and Marriage Settlements (WDRO 710/126a and b; 710/23). However some details on the use and occupation of the warren are included. Thus in 1760 John Lillicrap (presumably the son of Richard Lillicrap), William Eastlake and Edmond Jane were tenants of Trowlesworthy, which consisted of "One Messuage four acres of Meadows four Acres of Pasture Seven hundred Acres of Furze and Heath and Common of Pasture and Turbary in Leigh Moor". (WDRO 710/21b)

The four acres of meadows presumably refer to the enclosed field, **Mon** 130a, (4.33 acres) which was originally divided into two, probably by the bank, **Mon** 158, and labelled "Great Meadow" and "Little Meadow" on the

1842 "Rough Plan of Trolsworthy". (WDRO 710/203) (See Fig. 3:5) The four acres of pasture may refer to the fields, **Mons 1301 and n**, (2.38 acres) labelled "Clover Field" on the 1842 plan, and may also have included some of the other fields. (*ibid.*) However the 700 acres of furze and heath is rather more than the 483 acres contained within the original Trowlesworthy Boundary, which suggests that more land had been taken into the warren, possibly from Willings Walls, or Cholwich Town.

By 1792 Trowlesworthy Warren, formerly in the possession of John Lillicrap" was now in the possession of Thomas Nicolls as Tenant to Thomas Woollcombe. The Nicholls family appears to have had a major influence on warrening in UPV in the 18th and 19th centuries, and, indeed, enjoyed a monopoly for the first 30 years of the 19th century. There is some confusion over the relationship between different warren occupiers. Thus, according to a document in private possession, Peter Nicholls was admitted as a tenant to Trowlesworthy in 1793. (cited in Hemery 1983, 222) In 1807 Peter Nicholls also leased Hentor Warren. (WDRO 582/11/2) In addition, according to the Sheepstor church warden's accounts, Peter Nicholls was at Ditsworthy from some time between 1794 and 1800 to some time between 1816 and 1820, and at Legis Tor again from between 1794 and 1800 to between 1801 and 1805. (DRO PW1, PW2) Hemery claims that the Trowlesworthy Peter Nicholls was the son of the Hentor Peter though this is disputed below. (1983, 222) (see pp. 264-5) It is at least likely that the Peter Nicholls' at Trowlesworthy, Ditsworthy and Legis Tor was the same person, as a single name is again associated with all 3 warrens in the 1820's. Thus, Peter Nicholl's successor at Ditsworthy, after a brief tenure by Jane Nicholls (presumably his widow) was William Nicholls (presumably his son), who took over at some time between 1821 and 1824. In 1825 it was surely the same William Nicholls, who complained about damage caused to rabbit burrows on Trowlesworthy by workmen digging out an old leat, **Mon 47**. (see below pp.287-8 ; WDRO 72/949)

This is not to suggest that one person operated all the warrens single-handedly. Some may have been worked by other members of the family; indeed, William Nicholls was in charge of Legis Tor warren from at least 1805, while Peter Nicholls was still at Ditsworthy. (DRO PW2) Alternatively, the Nicholls may simply have employed a warrener. Thus

Hemery stated that Henry Lavers worked at Trowlesworthy before succeeding to the tenancy in his own right. (1983, 222)

In summary, it appears that, from 1792, Trowlesworthy was leased by Peter Nicholls who at about the same time also leased Ditsworthy and Legis Tor. William Nicholls took over Legis Tor before 1805, Ditsworthy before 1824 and Trowlesworthy at some time before 1825. Both men probably lived at Ditsworthy as they took an active part in parish affairs at Sheepstor; both took their turn periodically as churchwardens. (DRO PW2) Although Hemery suggests that it was Peter Nicholls who built the present house at Trowlesworthy, it may have mostly been occupied by an employee. (1983, 222)

At some stage Henry Lavers arrived at Trowlesworthy possibly initially, as noted above, as an employee. However by 1840 when the Tithe Map was drawn, he was the occupier of Trowlesworthy Warren. Henry Lavers also succeeded William Nicholls at Legis Tor, at some time between 1835 and 1839. (DRO PW2) Thus while the Ware family had taken over Ditsworthy (see below p. 262), Trowlesworthy and Legis Tor, at least, were still worked together.

John Lavers followed Henry at Trowlesworthy and Legis Tor in 1841. His family was recorded at Trowlesworthy in the 1841 census though he himself was absent, while he is first chargeable for Legis Tor in 1842. (DRO PW2 and 1842 Tithe Map) In 1861 John's son Richard was working as a" rabbit warren labourer" at Trowlesworthy and by 1871 had succeeded his father as warren keeper. (PCL RG9, RG10)

Richard Lavers was assisted on the warren by Robert Giles, who subsequently took over the warren after Lavers' death in 1914. (Hemery 1983, 224) Robert Giles continued as warrener until the Rabbit Clearance Order brought an end to warrening at Trowlesworthy in 1956. (*ibid.*)

b) Ditsworthy

Warrening seems to have been introduced to Ditsworthy at some time before 1676. Thus in a lease issued in that year by Sir Nicholas

Slanning to "Edward Meade ... Warrener" the property is already entitled "Dittisworthy also Dittsery Warren". (WDRO 70/189) Edward Meade may still have been associated with the creation of the warren; prior to succeeding to the property in his own right in 1676, he had a joint tenancy with Martha Shepherd, whose late husband had been a previous lessee. (*ibid.*) The association of a John Meade with the earliest reference to warrening at Trowlesworthy has already been noted and, thus, the consequent possibility that a single family introduced rabbit-warrening to the Plym Valley.

According to the 1676 lease, Meade was granted "liberty and power .... to contineu the said messuage and tenement of Dittisworthy to A conie warren as now and heretofore has bynn used and there to hunt by ferrett and pitch nette" He was also granted "comon of pasture on all the waste of the said Sir Nicholas Slanning adioyning to the forrest of Dartmoore for so many beasts and cattle as may be wintered on the premises".

The lease was granted for 99 years or for the lives of Prudence, Meade's wife, and Edward his son. Meade was required to pay a consideration of £85 and an annual rent of 20 shillings, as well as provide a capon at Christmas or 12d in lieu, "one harvest journey" on the Barton of Maristow, or 4d in lieu and 2d at Michaelmas. In addition, a heriot of a "best beast" or 40 shillings in lieu was payable on the deaths of Prudence and Edward Junior.

The various seigneurial conditions were similar to those imposed on the tenants of Ditsworthy when it was still a farm in 1493. (see above p. 198; WDRO 70/183) Edward Meade was required to attend the manor court of Bickleigh" when and as often as any Court shall be theire holden". (WDRO 70/189) He was required to "Grinde all his ... Corne and Graine which shall be growne and spent on the premisses att the Mills of the said Sir Nicholas Slanning called Bickleigh and Shaugh Mills". He also undertook to "finde one sufficient and able labor man one day yearely to help repare and scower the head weares and leats belonging to the said Mills". In addition, he had to repair and maintain "houses hedges ditches gates and fences" for the purpose of which he was permitted "to have and take sufficient Tymber on the premisses groweing".

Finally Sir Nicholas Slanning reserved the right to repossess the property if rent was 3 months late, if any damage was not repaired within six months, or if he should "wilfully permit and suffer his conies to depasture on Ringmoore Downe or Commons to the prejudice of the said Sir Nicholas Slanning his heires or assignes or his or theire Tennants".

When the churchwardens accounts of Sheepstor parish open in 1718, Ditsworthy was still occupied by an Edward Meade, either senior or junior. (DRO PW1) However, in 1719 the property was leased by Dame Elizabeth Modyford to William Nicholls for 99 years or for the lifetimes of his sons John and Richard. (DRO PZ11) William Nicholls, who had previously occupied Little Yellowmead (FN 1), was required to pay an annual rent of 20 shillings and a heriot of "a best Beast or forty shillings in lieu thereof". (DRO PW1; PZ11)

By 1718 William Nicholls also occupied Legis Tor warren. In 1741 Nicholls was succeeded in both warrens by his son John. (DRO PW1; PZ11) The latter probably worked for his father before he took over; he was paid out of parish funds for vermin control, from, at least 1736 onwards. (DRO PW1) A lease was issued to him in 1755 by James Modyford Heywood of Maristow on the same terms as in 1719.

In 1762 the residue of both leases was assigned by John Nicholls to his son, also John, described as a "felt-maker". (DRO PZ11) John Nicholls Junior was granted:

> "free liberty ... for keeping of dogs [?Guns] Traps Netts and other Engines and Things for the destroying of foxes and other vermin the better to preserve and contain the same to and for a warren of conies ... [to hunt by] ... ferrett and pitch Netts." ... together with comon of pasture upon all the wasts of Dame Elizabeth Medyford ... adjoining the forest of Dartmore and Ringmore Down for so many Beasts cattle and sheep as may be wintered on the premises."
> (DRO PZ11)

FN 1 Yellowmead is a farm to the N of UPV at SX 572677).

The lessee was required to repay a mortgage of £180 plus interest to Nicholas Lyne, a felt-maker from Tavistock, as well as pay an annual rent of £3 to John Nicholls the Elder. In addition he was to provide the latter with "Drink Washing Lodging Attendance Cloaths and all other Necessaries fit and convenient for one of his Degree" or pay of sum of £10 annually to cover these expenses. Finally £6 per annum was to be paid after the death of John Nicholls the Elder to his widow Alice. (DRO PZ11)

John Nicholls (the Younger) is last recorded at Ditsworthy and Legis Tor in 1782, and in 1787 Richard Northmore is occupier of both properties. (DRO PW1) The warrens may have been sub-let, possibly still to the Nicholls family. Northmore is responsible for several other properties in Sheepstor parish, while John Nicholls obviously still resided in the parish; he was paid 18 shillings from parish funds in 1792-3 for repairing the church yard wall and £1 6s 8d in 1799-1800 to cover "a Bill of Arrears for Verments" [vermin]. (DRO PW1)

By 1800 the Nicholls family was in charge again; in that year the parish rate for Ditsworthy and Legis Tor was paid by Peter Nicholls. (DRO PW1) As suggested above he also leased, at about the same time, Trowlesworthy and possibly Hentor. In 1820 and 1821 Jane Nicholls, presumably his widow, was the occupier at Ditsworthy, but by 1824 William Nicholls, presumably his son, who had taken over Legis Tor Warren by 1805, had succeeded to Ditsworthy as well. According to William's widow's application for poor relief from Sheepstor parish in 1835 he rented the warren for about £50 a year. (quoted in Rendell 1989, 18) However "he quitted it at Lady Day, 1830, and went to Devonport where he hired and entered upon a public house". (*ibid.*)

The arrival in 1830 of Nicholas Ware introduced another family to UPV, which had a major impact on warrening. The Wares remained at Ditsworthy until warrening ceased shortly after the Second World War. By 1843 Nicholas Ware had also taken over Willings Walls and Hentor warrens. (Hemery 1983, 218) Between 1851 and 1853 Legis Tor warren was amalgamated with Ditsworthy (DRO PW2) and a lease issued in 1857 stipulated an annual rent of £125 and the maintenance of a population of 3000 couples of breeding rabbits. (Hemery 1983, 218)

In 1859 William Ware succeeded his father and extended the warren even further, acquiring all the land recently vacated by the closure of Eylesbarrow Mine. In 1881 the rent rose to £140, probably as Rendell suggests because of this increase in area. (1989, 13) By the end of the 19th Century, William Ware was succeeded by his son, Nicholas, who in turn was succeeded by his widow, Emmeline, known always as "Granny Ware". (Hemery 1983, 218-9) She continued to run the warren until her death in 1945, and the death of her son Percy only two years later brought an end to warrening at Ditsworthy. (Hemery 1983, 219)

c) Legis Tor Warren

Legis Tor Warren is first documented in 1718, in the earliest extant accounts of the Sheepstor church wardens. (DRO PW1) It was described then as "Legastor Warring" or the "new waring" though this latter title does not imply recent date; it was still known as the new warren when Crossing was writing in 1903. (Le Messurier 1966, 57)

In 1718, while Edward Meade was still at Ditsworthy, Legis Tor warren as well as Little Yellowmead was occupied by William Nicholls. The warren had been granted to him in a lease together with "a plott of ground thereunto adjoining containing six acres or thereabouts" and common of pasture on Ringmoor Down. (DRO PZ11) The six-acre "plott of ground" may correspond to the triangular area between Ditsworthy and Legis Tor warrens, bounded by **Mons 197b and c** and **Mon 629**, though this area covers 8.8 acres (3.6ha). This lease was granted for 99 years or the lives of Nicholl's son Richard and daughter, Margaret Bishop for an annual rent of 6sh 8d. (*ibid.*)

By 1719 William Nicholls had taken over Ditsworthy and the two warrens were amalgamated until at least 1801. As noted above, from between 1821 and 1824, Legis Tor warren was operated by the Trowlesworthy warreners; a clam bridge, **Mon 431**, recorded by Haynes, marked by an iron chain in the river bed, connected the two warrens. (Haynes Map TRO 45) However, at some time between 1851 and 1853, Legis Tor warren was again amalgamated with Ditsworthy and continued to be so until warrening ceased at Ditsworthy.

It has been assumed that Legis Tor warren was always worked in conjunction with another warren as it is too small and as there is no contemporary dwelling for a warrener. (Haynes 1970, 158) However, the church wardens' accounts indicate that Legis Tor was operated as a separate enterprise from at least 1805 by William Nicholls before he succeeded to Ditsworthy and presumably also Trowlesworthy at some time between 1821 and 1824. The account books also reveal that William Nicholls rented the church house in Sheepstor Village between 1817 and 1822, thereby partly solving the problem of a lack of a dwelling. (DRO PW2) Thus in 1817, Nicholls rented the house for £3 3sh per annum and undertook "to Pay the Window Tax and Keep the Glass of the Windows in Repare". (*ibid.*)

d) <u>Hentor and Willings Walls Warrens</u>

Hentor Warren is situated on the S bank of the R. Plym between Hentor Brook and Shavercombe Brook. Willings Walls Warren covers the area between Spanish Lake and Hentor Brook but, in the earliest documentary reference, it is already amalgamated with Hentor Warren. The two areas may always have been worked together unless the series of pillow mounds along Spanish Lake were worked in conjunction with pastoral farming at Spanish Lake farmstead.

The earliest evidence for warrening at Hentor is a lease issued in 1807 by Lord Boringdon to "Peter Nicholls of Sheepstor, warrener". (WDRO 582/11/2) (Document Extract 6) The lease granted for 50 years, for an annual rent of £5 "a certain common called ... lee moore", the extent of which was marked by boundary stones. Peter Nicholls was granted:

> "free liberty and power ... to keep Dogs Guns Traps Nets and other Engines and Snares for the destroying of foxes and other vermin and to employ the said Lands within the Bounds aforesaid for the run of Rabbitts as long as the same shall remain uninclosed." (*ibid.*)

Hemery suggests that Peter Nicholls was the father of another Peter Nicholls at Trowlesworthy and equates him with "the man named Nicholls", who, according to Crossing, ploughed the fields of Hentor farm with ten oxen in the second half of the 18th century. (Hemery 1983, 222; Crossing 1912, 432) However, this ignores the evidence that another Peter Nicholls also occupied Ditsworthy and Legis Tor warrens from at least 1800. (DRO PW1) It may be significant that the 1807 Hentor lease is issued to Peter Nicholls of Sheepstor, a description hardly appropriate to a sitting tenant of Shaugh Prior parish.

Therefore it may be suggested that Hentor warren was leased to the tenant of Ditsworthy. The extension of Ditsworthy across the R. Plym is documented later in the 19th Century during Nicholas Ware's tenancy and there is no reason why this arrangement should not have an earlier origin. Furthermore, a link between Ditsworthy and Hentor during the Nicholls' occupation is substantiated by the application for poor relief from Sheepstor parish by the widow of William Nicholls, who had succeeded Peter Nicholls at Ditsworthy. (quoted in Rendell 1989, 13) Thus Betty Nicholls stated that her late husband had been entitled by the Will of his father "to an annuity of Ten Pounds a year issuing out of a leasehold called Hentor in the parish of Shaugh". (*ibid.*) A clam bridge across the R. Plym near the ford, connected the two warrens. (Hemery 1983, 220; Haynes 1970, 159)

There are several implications. Firstly, the 18th Century farmer named Nicholls was not the lessee of Hentor warren and farming must have come to an end. This is supported by the wording of the lease which granted Hentor for the use of rabbits "as long as the same shall remain uninclosed". (WDRO 582/11/2) Therefore arable farming was not practised in the Hentor fields simultaneously with rabbit breeding in the adjacent pillow mounds, as might otherwise be concluded. It is difficult to see how this could be done successfully in any case. The 1807 lease may, therefore, mark the introduction of warrening to Hentor.

Secondly the departure of the Hentor farmer may have brought an end to the occupation of Hentor house. It seems at least to have been unoccupied by William Nicholl's time; Betty Nicholls states that "There was no Dwelling house on Hentor, and she is quite certain her said husband never resided within the parish of Shaugh", though she may have been trying to strengthen her claim to Sheepstor parish funds. (quoted in Rendell 1989, 13) Worth noted that the house was last occupied in the 1770's. (Worth 1889-90, 305)

Worth's account that a cupboard in Hentor house was known to the Ware family as "Mother Nicholl's Book place" might suggest occupation by the Nicholls at least until 1830 when the Wares arrived at Ditsworthy. (Worth 1889-90, 305) However this name could equally have been invented by the Wares when the house was empty.

Thirdly, it has already been suggested that the Trowlesworthy Peter Nicholls was the same as the Ditsworthy/Legis Tor Peter Nicholls. Now he seems also to be the same as the Hentor Peter Nicholls, and therefore not his son as Hemery suggests. This Hentor lease then suggests that, for a short period, one man leased all the warrens in UPV.

The subsequent history of Hentor warren mirrors that of Ditsworthy. The Wares operated Hentor warren by at least 1843 and probably took over on their arrival at Ditsworthy in 1830. (Hemery, 1983, 218)

e) Eylesbarrow

Eylesbarrow "warren" consisted originally of three pillow mounds, built amongst mine shafts on Eylesbarrow Hill and probably included a fourth, **Mon 806**, on Leedon Hill, just to the N of the Eylesbarrow-Sheepstor track. Presumably these were built for the benefit of the miners of Eylesbarrow Mine, which operated between 1814 and 1852, though there is no documentary evidence.

After the closure of the mine, the area was let to the Wares of Ditsworthy. In the lease issued in 1859 by Sir Massey Lopes, William Ware was required:

> "to fill up in an effectual and workmanlike manner all the mine-pits now on the said premises and thereon to erect and construct such burrows, trenches and other contrivances and to establish a warren for rabbits ... together with a stock of five hundred couples of full-grown breeding rabbits". (quoted in Hemery 1983, 218)

There is little evidence for the construction of "burrows, trenches and other contrivances". However, the two pillow mounds, **Mons 1029 and 1033** and the four possible unfinished pillow mounds, **Mons 1014, 1015, 1016 and 1017** at Drizzlecombe, which are all nearer to Ditsworthy than the mine, may date to this period.

4.3 ARCHAEOLOGICAL EVIDENCE

4.3.1 The Enclosure of the Warren.

Perhaps the most costly commitment in terms of time and money was the enclosure of the warren. The purpose of a barrier was both to keep the rabbits within the warrener's control, and, more importantly to prevent damage to surrounding cultivated land. In the earliest phase of warrening, in a period of relatively low density of land use, occasional patrols to drive escaped rabbits back to the warren may have been sufficient. (Sheail 1971a, 44-5) However, the threat from predations of rabbits was recognized from the beginning. As early as 1254-57 the burgesses of Dunster, Somerset were complaining about the destructiveness of rabbits. (Lever 1977, 67) In 1340 the Bishop of Chichester's rabbits, possibly from a warren at Cakeham Manor, Sussex were known to have damaged crops at West Wittering, which were "thereby lessened in value £7 6s 8d." (quoted in Tittensor 1986, 3) The increasing damage until the eventual decline of warrens will be discussed below. (section 4.5) However, these examples serve at present to indicate the wish, presumably shared by farmers near all warrens across the country, to ensure sufficient enclosure of rabbits.

A water barrier was, at first, considered to be the most effective boundary and probably this was the reason why islands were selected at an early date. Rivers and streams were similarly effective and, indeed, form at least part of the boundaries of all the UPV warrens. (described in detail below p.270) However, a water barrier is not impassable and, although it appears that rabbits will not venture far where there is sufficient food and safety at hand, they can cover considerable distances, regardless of obstacles, if necessary. Thus rabbits often swam across a boundary brook at Driffieldgreets warren in the East Riding of Yorkshire. (Sheail 1971a, 47) A water barrier is even less effective when frozen over; thus in the harsh winter of 1796-7, a rabbit colony crossed the ice on the River Yare, Norfolk. (*ibid.*)

The likelihood of escape was probably recognized early and, in the lease of Vaghill warren in 1613, provision was made for the capture of any rabbits crossing the boundary brook:

> "And also if any rabbits go over the Darte to the commons there called Holne Commons alias Holne Cleyves between Comson [Combestone] hedge and Whortaparke corner [on Stoke] or to any place in the said Common of Spitchwicke the said Richard and Walter [the lessees] may kill them". (quoted in French and Linehan 1963, 174)

The provision of a more effective barrier may have become imperative with increasing enclosure of marginal land and agricultural improvements as well as wider recognition of rabbit damage. Farmers may have resorted to desperate measures. Thus, in 1736, the freeholders of Kirton, Lincs. paid £60 to the lord of the manor of Redbourne to build an enclosing wall in order to protect their own lands. (Sheail 1971a, 45) The provision of a wall may also have been written into leases. Thus the Michelmore family of Huntingdon warren, Dartmoor contracted to enclose the additional land, leased in 1809:

> "If within 10 years from commencement of lease any part of the said uninclosed land shall not be inclosed and fenced in then it shall be lawful for the Duchy to reenter upon such portion of uninclosed land making proportionable allowance to the Lesee for such land re-entered upon at the rate of 2d per Acres". (quoted in Hemery 1983, 310)

In UPV, the lease, noted above, issued to Edward Meade in 1676 for Ditsworthy Warren was to be terminated if any rabbits escaped to graze on Ringmoor Down. (WDRO 70/189)

It might be supposed that a wall would not present an insurmountable barrier to a burrowing animal. Rabbits can burrow to considerable depths; the probing of one burrow system in an experimental warren found the burrows to reach 20ins (0.50m) below ground surface (Lockley 1965, 53), while they have been recorded to a depth of 9ft (2.74m). (Thompson and Worden 1956, 88) In another experimental plot, a burrow was found to extend horizontally under a fence for 54ft (16.46m). (*ibid.*) Furthermore, rabbits have been observed to climb wire-netting (*ibid.*), as well as sloping walls and trees. (Simpson 1895, 25-6)

To combat these exploits, particular care is required in the construction of a rabbit-proof fence. Simpson (1895, 91-4) advised the use of 1 1/4 inch netting for the lowest 18ins (0.45m) to contain the smallest rabbits, while a 1½ inch mesh was sufficient for the upper part. Maximum security was provided by a 6ins (0.15m) wide flap at the top and bottom; an inturn of netting at the top, held in place by iron bolts, prevented rabbits from climbing out, while a horizontal flap at the bottom obstructed tunnelling. (*op.cit.*, 95-101) This can be made even more effective if the wire mesh is sunk below ground level for 6ins (0.15m). (Thompson and Worden 1956, 190) However, the much greater cost and effort is far above any benefit, and current guidelines, from the Forestry Commission, recommend a 0.15m wide, inturned horizontal flap, at ground level, held in place with turves, unless a countersunk fence is absolutely necessary. (Pepper 1976, 5) It might, therefore, be concluded that a turf or stone wall, built on ground surface, will not restrain rabbits. An observation that extensive burrowing in the period of maximum rabbit pressure in the early 20th century, was causing hedge-banks to collapse, suggests a considerable amount of tunnelling under walls. (Tittensor and Lloyd 1983, 3)

However, a wall presents a much more substantial obstacle than a fence and it would take a very determined rabbit to tunnel under a 1-2m thick wall, particularly as the destination would be as yet unseen. A view of life across the fence is the usual enticement for a burrowing animal, and this would be absent in the case of a solid barrier.

The walls constructed for the purpose vary considerably in composition. A bank of earth or grass sods could have been sufficient. A typical turf wall may have comprised two rows of sods 16ins by 12ins (0.40m by 0.30m), laid face down to a height of 6ft (1.83m). (Sheail 1971a, 45) A 4ft high turf bank comprised the 8-mile long perimeter at Thetford Warren, Suffolk. (*ibid.*; Wood 1972, 235) This was presumably the cheapest barrier but required regular maintenance; a bank of sods had to be replaced, at least, every seven years. (Tittensor 1986, 3) It might also be supposed that rabbits could clamber over such a bank though some were capped with furze, blackthorn or reed to prevent this, as well as to protect the turves. Another method, which was expensive and again requiring constant maintenance, was a fence of wooden palings, such as at Driffield, Yorks. (Sheail 1971a, 45)

Possibly more effective and certainly more durable was a stone wall. Again methods of construction vary. The wall could be of coursed stone, topped with wooden palings, furze, blackthorn or reed, though wire netting prevailed in the 19th century. (Tittensor 1986, 3) It could be an earthen bank, faced with coursed stone masonry. Excavation of part of the perimeter wall at West Dean Warren, Sussex revealed such a construction. Soil and spoil from a 2m wide and 0.70m deep internal ditch was piled up behind a drystone flint wall to make an external bank, 0.90m high and 2.90m wide. A single stakehole on top of the bank may indicate a fence. (Tittensor 1986, 32-33, Fig 8) The flint facing was designed presumably to prevent rabbits from scrambling up the bank, while a fence on top of the bank would have added a further obstacle.

Enclosure may have been particularly desirable in a commercial warren in the effort to maximize the catch and profits. A larger population of rabbits presumably also posed a greater threat to adjacent farms. Thus Trowlesworthy, Ditsworthy, Legis Tor and the combined warrens of Hentor and Willings Walls are all enclosed by a variety of methods. However, enclosure may not have been thought necessary at Eylesbarrow in common with other warrens such as Redlake Tramway, New House and Holne which consist simply of a few, if any, pillow mounds to provide a food supply for a local population. Eylesbarrow remained unenclosed after its amalgamation with Ditsworthy.

a) Trowlesworthy Warren

Trowlesworthy Warren is almost completely enclosed by water. Thus it is bounded by the R Plym on the N and NW sides, by Blacka Brook on the SW, by the South Boundary Brook on the SE and by Spanish Lake in the NE. What is now a low, turf bank, **Mon X4**, fills the only gap in this water barrier, between Spanish Lake Head and the source of the South Boundary Brook. It may, as already noted, have been built only when complete enclosure was necessary with the introduction of warrening, and was probably then a more substantial barrier. A topping of furze or wooden palings may have been provided.

b) Ditsworthy Warren

The S side of Ditsworthy Warren is enclosed by the R. Plym. The W boundary is defined by a substantial corn-ditch, **Mons 624b and 629**, which runs from Sheepstor Brook in the N, round Gutter Tor, southwards and then eastwards to the confluence of Meavy Pool and the R. Plym. As described above, corn-ditches were traditionally built on Dartmoor to separate the Commons from the Venville and were designed to prevent wild animals or livestock from entering cultivated land. (see above p.162) Such boundaries consisted of an earthen bank, faced externally with dry-stone masonry. It is assumed that when Ditsworthy ceased to be a farm, the fields were adopted by the warreners, who continued to use the corn-ditch as a boundary on the W side. However, the stone facing would have been superfluous outside the enclosure, while the grass-covered bank on the E side may not have provided a sufficient obstacle to rabbits. Thus a capping of palings or furze may have been necessary.

The E boundary is defined by an eroded turf bank, **Mon 730**, which is presently 0.30m high. However, the presence of a gateway, **Mon 731**, indicated by one recumbent granite gatepost with an iron gate hanger still attached, and another upright post (though re-erected the wrong way round) demonstrates the former existence of a superstructure, either wooden palings or a fence, over 1m high. A few stones visible on the SW face of the bank suggests that a revetment also originally strengthened the defences. This boundary is also marked by two granite pillars, **Mon 729**, which stands 5m to the S of the bank and **Mon 732**, which is contained within the bank.

The earthen bank, **Mon 733**, may originally have continued the boundary as far as Sheepstor Brook but seems to have been interrupted by tin streamworks in Gutter Mire. However on the Tithe Map of 1843, the N boundary of Ditsworthy seems to continue across Sheepstor Brook from the present N end of the corn-ditch, **Mon 624b**, passing S of the plantation to the Longstone Leat, **Mon 717**. The latter then forms the NE boundary as far as the sharp right-angled bend, known to Hemery as Elbow Gutter. (1983, 164) A fence might have crossed the gap to the corner of **Mon 733** or to the NW end of **Mon 730**.

c) <u>Legis Tor Warren</u>

Legis Tor Warren is bounded on the S and E by the R. Plym and on the W and N by a wall, **Mon 197a**. The latter survives up to seven courses high and consists of large boulders at the base topped with smaller stones. At present the wall stops at the S end of a wall, **Mon 624a**. However a dilapidated wall, **Mons 197b and c**, continues further E and it is suggested that originally this continued the Legis Tor boundary to the R. Plym, just downstream from its confluence with Meavy Pool. When Legis

Tor and Ditsworthy warrens were operated separately a complete boundary may have been necessary. As suggested above, the area between **Mons 197b and c** and the S boundary of Ditsworthy, **Mon 629**, may correspond to the six-acre "plot of ground", leased along with Legis Tor Warren to William Nicholls before 1718. (DRO PZ11) The wall may have been partly dismantled when Legis Tor and Ditsworthy were worked together, but probably not until their permanent amalgamation by the Ware's in the 1850's.

A similar combination of stone wall and stream can be seen at Huntingdon Warren, where, in an early phase, a wall enclosed a peninsula, otherwise bounded on three sides by the R. Avon and Western Wella Brook.

d) Hentor and Willings Walls Warrens

The amalgamated warrens of Hentor and Willings Walls are enclosed on three sides by streams: Spanish Lake in the SW, the R. Plym in the NW and Shavercombe Brook in the NE. In this case the fourth side remains open and is simply defined by boundary markers, as described in the 1807 lease noted above. (WDRO 582/11/2) (see document extract 6) Here the boundary ran from "a certain row or heap of stones joining Trowlesworthy Warren and Spanish Lake Head", which Brewer equates with the Willings Walls Reave, **Mon 540**. (WDRO 582/11/2; Brewer 1986a, 53) However, this description perhaps corresponds more accurately, as Haynes suggests, with the boundary bank, **Mon X4**, which joins Trowlesworthy's South Boundary Brook with Spanish Lake Head. (Haynes 1979b, 98) The boundary continued to "a large rock marked with the initials H.W.B. No 1", "about forty land yards" away, which Haynes calculates to be about 220 yards (201m). (WDRO 582/11/2; Haynes 1979b, 98) This is **Mon X7**, a large groundfast boulder engraved HWB1, lying about 190m from **Mon X4**. (See Fig. in Brewer 1986a, 53).

Two granite posts, **Mons 564 and X8**, engraved HWB2 and HWB3 respectively, are the next bound-stones, both of which have been re-erected since Haynes described them in 1979. (Haynes 1979b, 98) (see Plates 4:1 and 4:2) **Mon 564**, said to be 80 (land) yards (402m) from **Mon X4**, is actually about 610m away, standing on a prominent position in the middle of Willings Walls Warren. **Mon X8**, described as 40 (land) yards (201m), S of "the large upright rock in Hentor Tor", is 190m from the

Plate 4:1
Hentor Warren Boundary Stone (HWB2), **Mon 564**

Plate 4:2
Hentor Warren Boundary Stone (HWB3), **Mon X8**

main outcrop. (WDRO 582/11/2) A fourth stone, engraved HWB4, at "the Head of Shabbacombe Lake" was recorded on early OS Maps but had been lost by 1979. (Haynes 1979b , 98). However, in 1987, it was found face down by Paul Rendell at Shavercombe Head, NGR 603653. (Anon, 1987, 2). A fifth stone, said to be at Colesmills Stamping Mill (**Mon 1004**) remains to be discovered.

No physical barrier was erected along this boundary, which is effectively the watershed on the SE side of the Plym Valley. However, this may have been sufficient as the boundary faces open moorland and would offer no threat to cultivated land, while the inhospitable environment would soon prompt any escapees to return.

A similar hope may have existed at the Dartmoor Warrens of Vaghill and Headland, which were open on one or more sides. Thus Vaghill was bounded on the W and S sides by the R Dart and on the SE by Rowbrook but remained open to the N and NE. (French and Linehan 1963, 174; Haynes, 1970, 103) Headland Warren was bounded by Wellabrook and West Webburn River on the W and E sides respectively and was open to moorland on the N side but, significantly, was enclosed by a stone wall on the S side, adjacent to the long-occupied farms of Soussons and Challacombe. (Brewer 1986b, 23) Headland is the only other Dartmoor Warren with a boundary clearly defined by marker stones. (FN 1) Brewer located 15 and possibly 16 stones all but two of which were inscribed "WB". (Brewer 1986b, 22) The stones were placed all around the perimeter, but with a particular concentration (10 in all) on the northern unenclosed side. (*ibid*)

4.3.2 Lodges.

> "I found him here as melancholy as a lodge in a warren". (Much Ado About Nothing II,i,222)

The formation of warrens in isolated places necessitated the construction of a warrener's house or lodge, which could be occupied throughout the year or only in the catching season, as a deterrent to poaching. Dwellings varied from the comfortable lodge at Kings Somborne,

FN 1 Two boundary markers are also recorded on Skaigh Warren. (Brewer 1986a, 57)

Hants. with "a hall, a faire wainscote, parlor, a kitchen, a milkhouse and other necessarie rooms below stares and five chambers above stares with one small barne and stable with a garden and backside" to the modest two-roomed wooden cabin built at the end of the 19th century to accomodate the keeper of Wistman's Wood warren, Dartmoor. (Sheail 1978, 344; Hemery 1983, 456; Le Messurier 1966, plate opp. 64) This was also occupied all year round, though for less than 20 years.

The warren lodges in UPV are substantial houses, built as permanent residences. The two-storey house at Trowlesworthy, **Mon 130h**, which is still occupied as a farmhouse was, according to Hemery, built by Peter Nicholls at the end of the 18th century. (1983, 222) Descriptions of outbuildings and enclosures are provided in the Tithe Map and Apportionment of 1840-41 and in 20th century recollections by Haynes and Hemery. (Haynes Map TRO; Hemery 1983, 222-4) Prior to this, the warrener may have occupied the longhouse, **Mon 130f** (fig 3:4), which had been built during the period of farming at Trowlesworthy. It is also possible that the small two-compartment rectangular structure, **Mon 72**, within a prehistoric enclosure, **Mon 71a**, to the SW of Great Trowlesworthy Tor, housed a warren labourer. Haynes suggests that it is of 17th century origin, but it was out of use by the mid-19th century; it does not appear on the 1842 "Rough Plan of Trolsworthy" or the 1841 Tithe Map. (Haynes Map TRO; WDRO 710/203)

As warrening in UPV was introduced to land previously devoted to agriculture, other houses may originally have been built as farmhouses. Thus, although the exterior of Ditsworthy Warren House, **Mon 880m**, is 19th century, the underlying structure may be as early as the 16th century, and, therefore pre-date the introduction of warrening. (OS Card) Again details of outbuildings and enclosures are provided by the Tithe Map, Haynes and Hemery. (Haynes Map DIT; Hemery 1983, 219-220) The interior of the house was illustrated in <u>Crossing's Dartmoor Worker</u>. (Le Messurier 1966, opp.64)

It was suggested above that Hentor House was not occupied as a warren house; it was almost certainly built before warrening commenced. (see above p.265) There is no warren house at Legis Tor warren but, as noted above, for the short period in which Legis Tor was operated as a separate enterprise, the warrener occupied the church house in Sheepstor village. (see above p.264)

4.3.3 Pillow Mounds

In areas where conditions are unfavourable for burrowing, it was necessary to simulate the rabbit's ideal environment of well-drained sandy soil. For this purpose, earthen mounds, known to the Dartmoor warreners as "buries", were built. The phrase "pillow mound" was coined by Crawford to describe the broad, flat-topped rectangular mounds found in Wessex, but it is now generally applied to all mounds constructed for rabbits, regardless of shape and even includes circular and cruciform mounds. (1927, 432) The mounds on Dartmoor tend to be, like those in Wales, narrower and less sharply rectangular with rounded ends and rounded tops. (RCAHMW 1982, 314) (see Plate 4:3) The presence of pillow mounds in areas, where conditions are suitable for burrowing prompted Williamson and Loveday to suggest that they were also built to facilitate netting. (1988, 296) (see below p.321)

The practise of building and maintaining artificial mounds is documented from perhaps the 13th century. A reference in 1281 to "places for the dwellings of the rabbits" enclosed by a ditch and a hedge on a warren at Benetley, Worcs. may refer to pillow mounds. (quoted in RCAHMW 1982, 313) Further, an illustration from Queen Mary's Psalter, dated *c.* 1308, shows women netting rabbits with the aid of ferrets in a conical mound. (reproduced in Shahar 1983, plate 16) The earliest date for field evidence is the C^{14} assay of a.d. 1375 ± 60 for charcoal, considered by the excavator to have derived from burning immediately before the construction of pillow mound, PRN 8276 at Bryn Cysegrfan, Llanfair Clydogau, Dyfed. (Austin 1988, 151,146) Dating is a problem in excavated mounds because of the possible inclusion of later material by burrowing activities. However, apart from this one early date, archaeological evidence, summarised by Williamson and Loveday, indicates a Post-Medieval date for the construction of pillow mounds. (1988, 310) More documentary references appear in the 16th century. Thus extra help was required to establish a black rabbit colony in Henry VIII's warren at Hampton Court and a payment was made:

> "To Robert Bing, of the Wyke, smythe, for a great long nagre [auger] of irne, to make and bore cony holes within the kynges beries new made for blake conyes in the warren". (quoted in Sheail 1971a, 43)

Plate 4:3
Aerial photograph of Legis Tor Warren

In 1633, the sum of 16s was recorded as the cost of "Makinge cunnie burrows in the warren". (*ibid.*) In 1649, the warrener at Goddens Down, Micheldever, Hants. contracted to keep a stock of 1,000 couples of rabbits "in good and sufficient Burrowes" (*op.cit.*,82), and in 1722, the lessees of two warrens in Ewelme, Oxfordshire undertook to leave the "burroughs in both warrens " in good repair. (Sheail 1970, 62)

19th century accounts provide further details on the construction of artificial burrows. For example, in the early part of the century rabbit refuges were dug in the Highlands of Scotland to provide a home for rabbits imported from England.

> "We carried the hamper to some sandy banks in Dugarry and as the rabbits might weary if left to dig holes for themselves, busy hands and spades soon built up twenty or thirty foot refuges of turf, like six-inch square drains, at the end of which, if they pleased they might in due course dig holes for themselves. To our great joy, the dear little innocents every morning showed plenty of new holes dug, so that they soon were safe from their enemies." (Mackenzie 1985, 63)

In the later 19th century, Simpson instructed that artificial mounds be built in parallel lines about 100 yards apart. He recommended earthen conical mounds, four yards in diameter, with an external ditch, one yard wide. Access to the centre was to be provided by placing sods together in an inverted 'V'. (1895, 103-4) As this relates to the 19th century sporting warren, the shape of the mound may not be relevant. However, the insistence on even-spacing to facilitate netting, as well as ensuring regular grazing, is probably appropriate everywhere. (*op.cit.*, 102,105) Furthermore, Simpson stressed the need to make holes and place the rabbits in the burrows to prevent them wandering and sulking on the surface. (*op.cit.*, 105) Although Mackenzie's rabbits seem to have had no difficulty in adjusting, the need for an auger to bore holes in the Hampton Court burrows suggests that this may have been a common problem.

Unfortunately there are no contemporary reports of the construction of pillow mounds on Dartmoor. Mounds were being maintained on Trowlesworthy Warren during the life of the warrener, Mr. Richard Lavers (Haynes 1970, 148), but there was no knowledge of their initial construction. However, Crossing's description of construction, written in 1903, is surely based on information obtained from warreners. (Le Messurier 1966,62) He reported that a narrow trench was dug with smaller ones branching off it on both sides but not opposite to each other. Large slabs of turf covered the trench and a mound of earth was piled on top. Finally, a few holes were made in the sides for the rabbits to enter.

This method is not unlike suggestions sent into The Field in 1893. One correspondent recommended digging long trenches four feet wide and three feet deep along either side of a strip 50 to 60 yards long and five yards wide. The soil was heaped up in the middle and holes "made with a spade a foot or two into the heap". (The Field March 18 1893) Another writer suggested cutting a cruciform trench on a sheltered slope and placing on it "2 layers of rough logs, intermixed with chalk or light soil". Sticks were laid around it and hedge clippings om top. (*ibid.*)

Details of surveyed or excavated pillow mounds in other parts of the country may also throw light on the UPV sample. Pillow mounds have been recorded at many sites across southern Britain from Wales to Kent and as far North as Yorkshire, and are often the only indication, in the absence of documentary sources, of the former existence of a warren. Surveys in the early part of this century built up a considerable *corpus* of earthworks of different shapes and sizes but all identified as pillow mounds.

A long mound at Butser Hill, Hampshire (Piggott 1930, 199) flanked by a ditch on three sides, mounds at Shillingstone Hill, Dorset (Crawford 1928, 20) with incomplete ditches and a long, narrow mound at Earl's Hill, Tarrant Gunville, Dorset (*ibid.*) with a distinct surrounding ditch and rabbit activity were all interpreted as pillow mounds. Structural details were also recorded. At Minchinhampton Common, Gloucestershire, longitudinal and transverse grooves were recorded on the surface of some long grass-covered mounds. (Crawford 1928, 18) One mound was 62ft long, 17ft wide and about 1ft high, and had "a more or less continuous groove down the middle, with dents along it". Another longer mound, 132ft long, 27ft wide and about 1½ft high had "a longitudinal groove - a series of small depressions connected by a small trench. The latitudinal grooves, about 18in. wide, are not continuous across in every instance and some are arranged *en echelon*". An even longer mound, 160ft long, had "a longitudinal groove, and symmetrical, continuous latitudinal grooves." A rectangular mound, 60ft long and 20ft wide, at Giant's Grave, Wye, Kent (Crawford 1928, 18) had 2 transverse grooves as well as a ditch along each side. Grooves arranged in a grid pattern were recorded on a series of mounds at Steeple Langford Cowdown, Wilts. (Crawford 1928, 162-3) One of the latter, a cruciform groove on a circular mound, termed a "hot cross bun", is paralleled on two square mounds at Brow-dun, Dorset. (Warne 1872, 84) The nature of these grooves may be explained by the observation on other sites of a stony trench or groove. Thus, a stony groove in the middle of a 50ft long low mound was recorded at Lasborough, Gloucestershire. (Crawford 1928, 19), while "a rudely formed stone trench" was noted in long mounds in the parish of Llanelwedd, Radnor. (Bosanquet 1928, 205) The excavation "by trespassers" of a grooved mound inside Bury Hill Camp, near Bristol revealed what was described by the owner as a "flue". (Crawford 1928, 20) More recently recorded examples include segmented mounds at Traianglas, Brecknockshire, consisting of long mounds with transverse creases, and long mounds, topped with "narrow stony longitudinal ridges" at Cefn Cul, Brecknockshire. (RCAHMW 1982, 314)

More structural details are revealed by excavation. A circular mound at Farteg Hill, Glamorgan was found to be heaped up on a base of sandstone slabs, while two adjacent long mounds were laid on foundations of small stones. (RCAHMW 1982, 327-8, Fig.162) A long mound at Gelliwion, Glamorgan was also founded on a crude paving of large flags. (*op. cit.*, 343) These slab foundations may be versions, in a different material, of the "spread of large granite pieces", underlying a long mound at Bodwen, Lanlivery, Cornwall. (Harris *et al* 1977, 57) Amorphous arrangements of stones have also been found at Everage Clough, Burnley, Lancs., Rylstone, Yorks., Hollybush, Herefordshire and, possibly, Hinton Charterhouse, Avon. (Williamson and Loveday 1988, 300)

More complex foundations have also been found. At Llanelwedd, Radnorshire, a long mound was piled up on a longitudinal line of stones, which rested on a pre-existing, probably Neolithic, mound. Parallel kerbs and transverse stone lines sub-divided the whole into rectangular compartments. (RCAHMW 1982, 319) At Cefn Hirgoed, Glamorgan, two long mounds and two round mounds were built over a rectilinear grid formed of neat rows of stones laid on the old ground surface. (*op. cit.*, 339-342, Fig.180) A third long mound had no stone foundation. A single row of stones and lines of stones *en echelon* underlay mounds at Castell Odo, Gwynedd and Bury Hill, Avon respectively. (Williamson and Loveday 1988, 300)

A particularly intricate pattern of gullies covered with flat stones was found at the base of two pillow mounds at Bryn Cysegrfan, Llanfair Clydogau, Dyfed.. In the completely excavated example, twelve gullies radiated from the outer of two central concentric circles and were joined by other gullies to form a total of 23 outlets to the edge of the mound. (Austin 1988, 144-5, Fig. 12) A simpler arrangement was revealed in a separate group of mounds on the same site. This consisted of one longitudinal slab-covered gully with transverse gullies to the edge of the mound. (*op. cit.*, 148-9, Fig. 15) Rescue investigations at the same site also suggest the possibility of two levels of stones within at least two mounds, while a L-shaped mound had no stone content. (*op. cit.*, 149) Austin suggested that the stone-capped gullies were intended to act as the actual burrows, prompting Williamson and Loveday to suggest that all stone lines may have had a similar function. (Austin 1988, 154; Williamson and Loveday 1988, 302) However, it may be argued that some of these and probably all the amorphous spreads of stones were provided to facilitate drainage.

Pillow Mounds in UPV

A total of 202 pillow mounds is recorded in UPV; 57 on Trowlesworthy Warren, 11 at Willings Walls, 35 at Hentor, 45 at Legis Tor, 48 at Ditsworthy and 6 at Eylesbarrow. Apart from three circular mounds, **Mons 400b and 411** at Trowlesworthy, and **Mon 700b** at Ditsworthy, all are sub-rectangular in plan. These long mounds mostly fall within a range of between 8m and 40m in length, which is almost identical to the range found in the survey of 50 mounds in Glamorgan. (RCAHMW 1982, 320) Only six are over 40m and, of these, four, **Mons 217, 389, 814 and 858** are 51m or under. The re-use of field boundaries accounts for the great length of **Mons 134 and 923c**, which measure 95m and 100m respectively.

The pillow mounds, however, are usually between 4m and 8m, and occasionally 9m or 10m, in width, regardless of length. For example, two adjacent mounds at Trowlesworthy, **Mons 162 and 165**, are both 5.5m wide but 18.5m and 35m respectively in length. This pattern is repeated elsewhere; in a survey of 190 pillow mound groups in Britain, Williamson and Loveday found that the great majority were between 4m and 7m in width. (1988, 294) This suggests that length is a less significant factor in the construction and use of a pillow mound than width. A width of between 4m and 8m may have been the most convenient for maintaining and possibly constructing pillow mounds by digging out the flanking ditches and piling up material in between.

It is possible that variation in length corresponds to chronology, function or, simply, topography. At Bryn Cysegrfan, it was suggested that the eastern group of larger mounds were built at a later date than the western group of smaller mounds. (Austin 1988, 151) It might then be possible to detect a difference between pillow mounds of the 17th century warrens of Trowlesworthy and Ditsworthy and those of the later warrens, Legis Tor and Hentor. However, the longevity of the warrens precludes any comparison; pillow mounds could have been constructed, for example, at Trowlesworthy over a period of 150 to 200 years. The earliest mounds might differ from later ones but in the absence of dating evidence for individual mounds, any chronological distinction in size cannot be demonstrated.

Moreover, within groups of mounds, which might be considered to be contemporary, the variation in size is still marked. For example, the three long mounds, **Mons 400a, c and d**, closely-spaced with a circular mound within a drain, **Mon 399**, vary from 9.2m to 21m. Two mounds, **Mons 539 and 394**, enclosed by a bank and ditch, **Mon 395**, on the right bank of Spanish Lake, measure 18.5m and 34m respectively. The five mounds, **Mons 831a - e**, resulting from the modification of a bank, vary from 18m to 36m long.

However, it is possible to detect a slight difference in emphasis between warrens. Out of a total sample of 195 measured pillow mounds, four main size groups can be isolated. Thus 64 mounds (33%) are between 12m and 16, in length, 42 mounds (22%) are between 18m and 21m, 29 (15%) are between 25m and 28m, while 14 (7%) are between 32m and 36m. Analysis of sizes on individual warrens shows that Trowlesworthy has a marked peak in Group I (18m - 21m), whereas Ditsworthy and Legis Tor are more evenly spread between Groups I to III, and Hentor is spread over all four groups.

Alternatively, size may be determined by function. It may, for example, have depended on the number of rabbits, which a warrener wished to accomodate. If the width was fixed at between 4m and 8m, the warrener had to alter the length to achieve a required size. Sheail suggests that particular buries could be reserved for breeding but there is no evidence to suggest that these may be distinguished by size. (1971a, 41) The long mound within an enclosure, identified by Austin as a breeding unit, was situated next to a building, which presumably housed the warrener, who could supervise re-stocking. Perhaps some of the mounds nearest the warren houses served this function. Finally, the length of a pillow mound may simply have depended on the amount of space available for its construction or even the whim of the builder.

It might also be suggested that the circular mounds had a specific function, though this possibility is discounted by Williamson and Loveday. (1988, 294) Two of the UPV round mounds are situated within closely-spaced groups of mounds, **Mons 400a-d and 700a-e**. The third mound, **Mon 411**, is only tentatively identified as a pillow mound and illustrates the difficulty, highlighted by RCAHMW of distinguishing a solitary pillow mound from, for example, a cairn. (1982, 321) The two certain circular pillow mounds follow the pattern of those identified, by Williamson and Loveday, in one-fifth of mound groups; these were between 5m and 15m in diameter, with a conical or rounded shape and were higher than the long mounds. (Williamson and Loveday 1988, 294)

In UPV, only excavation will demonstrate if intricate patterns of burrows, such as those described above, were provided within the pillow mounds. It seems unlikely, that in the wet conditions, burrows would have been dug directly into the ground surface. However, some evidence of a stone-built foundation, presumably for drainage, is revealed by field survey. Thus a few stones protrude at the base of **Mons 33, 39, 79, 155, 192f, 199b, 377, 389, 394, 536, 537, 538, 542, 815, 857, 864, 879b, 1114 and X6**.(Plate 4:4) **Mon 806** is particularly noteworthy as it has several tilted layers of slabs protruding through one end. A similar stone

Plate 4:4
Pillow mound with stone foundation, **Mon X6)**

Plate 4:5 Foundation of uncompleted pillow mound, **Mon 1016**

content was observed by the Rev. Bray on a visit to Mis Tor (Merrivale warren) in 1802. In an account later published by his wife, he recorded 13 mounds, ranging in size from 24 to 48 paces in circumference and mostly about 4½ft high but up to 6ft high. Though he first concluded that these comprised a "sacred cemetery of the Druids" (Bray 1838, 232), he was later informed by his tenant of the association with warrening of similar mounds on Over Tor (the S part of Merrivale warren). (*op.cit.*, 342) One of the mounds, 24 paces in circumference "had its sides faced with stone" and nearby, another mound, 32 paces in circumference was "more distinctly faced with stone". (*op.cit.*, 232) This stone facing may correspond to the basal layer noted on some UPV mounds.

The crude nature of these basal layers suggests that they are akin to the slab foundations found under the round mound at Farteg Hill, Glamorgan and the long mounds at Gelliwion, Glamorgan and Bodwen, Lanlivery, Cornwall. (see above) However, this can only be proven by excavation. An alternative arrangement, similar to the base of small stones found under the two long mounds at Farteg Hill, Glamorgan may be represented by the four flat rectangular platforms of loose rubble above the left bank of Drizzle Combe, **Mons 1014-1017**.(Plate 4:5) These have been identified as unfinished pillow mound bases, though they have some uncharacteristic features. They are not arranged directly across the contour, but lie parallel obliquely across the slope. Furthermore no ditches were observed around the platforms although these would not necessarily be expected in unfinished mounds. Finally the platforms occur well away from the rest of the pillow mounds at Ditsworthy, but their position East of Drizzle Combe indicates that they may have been part of the Eylesbarrow extension of the warren in the mid-19th century. Similar bases of small stones under other pillow mounds in UPV would not be recognized in field survey. It would be quite feasible to find both methods of construction in use in UPV; the two types were juxtaposed at Farteg Hill, Glamorgan.

A third type of foundation consisted of a pre-existing bank or wall. Thus, in Hentor Warren **Mons 846a and b** were constructed on top of the NW part of a wall, **Mon 845b**. Other examples include **Mon 17**, built on the SW end of wall **Mon 18**, **Mon 607** on wall **Mon 606**, **Mon 734** on wall **Mon 733**, **Mon 844** at NW end of wall **Mon 842b**, and **Mons 923b and c** at E end of wall **Mon 923a.** Occasionally complete walls were modified, such as **Mon 900a** in Ditsworthy. Similarly, in Trowlesworthy, walls, **Mon 195** and most of **Mon 140b** may have been used as pillow mounds. (Haynes Map TRO) Wall, **Mon 134**, which may have been part of the Phase II field system, was enlarged into a pillow mound and said, by the last warrener Robert Giles, to be the best bury. (Haynes Map TRO) In Hentor warren, wall, **Mon 831** was enlarged, but divided into five individual mounds, **Mon 831a-e.** This suggests that they were perfectly happy with loose stone foundations rather than carefully-constructed bases with built-in drains. Re-use of existing monuments is not unknown elsewhere. Thus the re-use of a possible Neolithic mound at Llanelwedd, Rads. has already been noted and, at High Beech, Essex an Iron Age burial mound seems to have been utilized as a rabbit bury. (Crawford 1928, 21-23) At the latter, local inhabitants remembered "construction" of mounds 50 or 60 years before but excavation revealed undoubted traces of burning and burial and it was suggested that the local memory concerned the maintenance and reuse of a prehistoric mound. It is also possible that mounds had no foundation, such as the excavated examples of the L-shaped mound at Bryn Cysegrfan and a long mound at Cefn Hirgoed. Again, these were adjacent to mounds with stone bases.

Therefore, different methods of construction are demonstrated, though the purpose of these differences is unclear. The foundations were presumably provided to facilitate drainage but the particular method may have been determined by the availability of materials or simply local preference.

A further problem with the UPV buries is the composition of the mound above the stone foundation. Normally, the mound would have been composed of material excavated from the ditch. It might be supposed that the thin peat soil of the moor would not furnish a great amount of material. It might be suggested that a suitable material is to be found in the bottom of all the valleys of the Upper Plym and its tributaries, namely the sand and gravel waste,which is the residue from tin streaming. That rabbits liked this material is demonstated by the number of pillow mounds made directly from the waste heaps, such as **Mons 438, 583 and 863.** A ditch would be all that was required to convert these into buries. Hemery (1983, 645) noted the amount of burrowing activity in the abandoned tinning heaps at Headland Warren. It is therefore possible that some sand and gravel could have been utilized to produce the large pillow mounds of the UPV. Williamson and Loveday noted other examples of mounds, composed of material brought from a distance, where presumably not enough was available in the immediate vicinity. (1988, 300)

With or without a stone foundation, drainage was a primary requirement for pillow mounds. In the Upper Plym Valley most of the mounds have ditches around three or four sides. Where the ditch is absent it is assumed rather that the ditch has become clogged and is no longer visible, than that it never existed at all. A ditch would have particular importance on the wetter Dartmoor landscape. As an extra precaution a ditch, shaped like an inverted 'V' in plan, for example **Mons 57, 61, 190, 212, 357a, 399 and 697,** is sometimes dug upslope of a single or a group of pillow mounds, already provided with an individual ditch. In Trowlesworthy there are also many of these ditches without internal mounds, for example **Mons 32, 59, 67, 77a and b, 78, 80, 106, 348, 354, 356, 368, 375, 427 and 430**, and it is assumed that the ditch was sufficient encouragement for burrowing. Presumably there was good depth of soil, and evidence of rabbit activity demonstrates their success. (Haynes 1979a, 56) Drainage is further facilitated by the siting of the mounds across the contour.

Finally, it may be appropriate to consider the cost and effort of providing artificial burrows. Simpson believed that "two good men will throw the heaps up in a very short time" (1895, 106), and he calculated the cost of his conical earthen mounds at 9d per cubic yard. (*op.cit.*, 103) However, a stone foundation would require rather more effort. Otherwise, in 1633, the cost of making burrows for Lord Howard was recorded as 16s (Sheail 1971a, 43) and at an unspecified time, the sum of £12 10s was paid to a warrener at Elveden Warren in the Breckland. for making 500 burrows. (Sheail 1978, 346)

The value of mounds and pasture in 19th century Dartmoor is indicated by records of a dispute between the warrener at Trowlesworthy and the owner of Bottle Hill Mine. Workmen engaged in clearing out an old leat, **Mon 47**, to serve the mine in 1825, caused damage to pasture and burrows. The damage was listed in a lawsuit brought to the King's

Bench by William Nicholls, the warrener against Nicholas Fezzey [or Vesey] of Bottle Hill Mine:

> "and then and there with feet in walking had down trampled on and spoiled the grass of the said plaintiff there and then growing and being of great value to wit of the value of £5 and also with spades Mattocks and other implements then and there subverted and threw up the earth and soil of the said close. And also then and there with the implements aforesaid dug up and destroyed divers to wit 50 rabbit burrows there being and of great value to wit of the value of £50". (WDRO 72/949)

4.3.4 <u>Vermin Traps.</u>

Rabbits, especially the weak and the young, are a relatively easy prey; their best defence is darting speed. Although over any distance, the rabbit is slower than the hare, its initial spurt is generally sufficient to reach a burrow. However, even in the burrow the rabbit is not always safe. When cornered, the rabbit has little armoury though it will stand up to an attacker in defence of its young. (Hurrell 1980, 253; Harting 1898, 20)

The rabbit has a long list of enemies. All the mustelids are notably partial to rabbits and are well-equipped to catch them. The stoat is a particularly relentless hunter of the rabbit and probably kills more than any other predator. (Sheail 1971a, 31) It is capable of taking a rabbit on the surface as well as in a burrow. The smaller weasel is also effective, particularly underground. (Harting 1898, 38-9) Both stoat and weasel are prevalent in moorland Dartmoor, especially amongst clitter. (Harvey and St.Leger-Gordon 1953, 85)

Formerly the polecat was a serious problem to warreners and was common among rocks and clitter in Dartmoor valleys. (*op.cit.*, 86) However, the population had dwindled by the 19th century, though they were in sufficient numbers around Two Bridges in the middle of the century to warrant a pack of hounds specifically for polecat hunting. (Harvey and St.Leger-Gordon 1953, 85) However, they were very scarce by 1862 (*ibid.*) and were not known in Devon after 1937. (Hurrell 1972, 76)

A similar fate awaited the pine-marten, also a keen hunter of rabbits. Once present in small numbers in Devon, thorough destruction in the 17th and 18th centuries ensured extinction in the county by the 20th and probably the 19th century. (*ibid.*) Though essentially a woodland creature, some may have strayed to the edge of the moor. It is possible that a specimen formerly in the museum of the Plymouth Institution came from Trowlesworthy, though an alternative provenance of Buckland-in-the-Moor was also recorded. (Harvey and St.Leger-Gordon 1953, 119)

The badger's varied diet includes rabbit; its method of digging out burrows is particularly effective in taking young from nests. (Sheail 1971a, 31; Harvey and St.Leger-Gordon 1953, 85) The presence of numerous badger setts along valley sides demonstrates a significant population in UPV in recent times. (Haynes Maps) Another adversary is the fox, who captures rabbits on the surface by stealth (Harting 1898, 39), as well as in burrows by digging. (Sheail 1971a, 31) Rabbits form the bulk of the diet of the Dartmoor fox. (Harvey and St.Leger-Gordon 1953, 84) The ferocity, size and weight of the common brown rat are well-suited to taking rabbits, particularly the young. (Harting 1898, 39) However, while the brown rat frequently occurs on farmland in Devon there may have been little incentive to spread to moorland. (Harvey and St.Leger-Gordon 1953, 84) Domestic cats can also acquire a taste for rabbit, though this may have been an unlikely hazard in depopulated moorland.

Finally, rabbits are at risk from the air; golden and white-tailed eagles, buzzard, goshawk, brown owl and members of the crow family can all capture rabbits, especially the young. (Harting 1898, 44-5) However, of this group. the buzzard, carrion crow and raven are the particular culprits on moorland Dartmoor. (Harvey and St.Leger-Gordon 1953, 82)

Faced with such attack, it might be supposed that the rabbit has little chance of survival and it was believed in the 18th century that extinction was imminent. (Sheail 1971a, 31) The wholesale destruction of predators in the 19th century is usually held partly responsible for the great increase in the rabbit population. However, the introduction of the fox to Australia and mustelids to New Zealand, to combat the infestation of rabbits, had little perceptible effect on the rabbit population (Thompson and Worden 1956, 187), and it might be argued that predators will only have a significant effect on an already low and struggling population.

a) <u>Stoats, Weasels and Polecats.</u>

Nevertheless, the warrener obviously wished to minimize losses. Different species of predator required different methods of control. On Dartmoor the stoat, weasel and formerly the polecat formed the biggest threat to rabbits, and certainly made the biggest impact on the archaeological record.

The earliest method of catching mustelids is not recorded. The long history of the snare (Bateman 1971, 169) makes it a possible candidate, though its efficacy in holding these animals is questionable; their narrow, lithe bodies may enable them to wriggle out of a noose. Alternatively, any trap, such as a deadfall, designed to kill its victim, would also endanger the rabbits. Thus a box trap, which could imprison an animal alive was required; any rabbit or harmless creature caught accidentally, could be released. Remains of these vermin traps are found on Headland, Huntingdon, Vaghill and Sheepstor warrens but the largest number and some of the best-preserved examples occur in the Plym Valley. Thus, the sites of 53 vermin traps are recorded in UPV, while remains of six actual traps survive *in situ*, **Mons 639, 678, 695, 738, X1 and X2**. Another 23 sites, including remains of five traps were recorded by Haynes (1970, 156-161) and Cook (1964, 198-201). (See App. G)

The trap, **Mon X2**, found *in situ* on the South side of the main outcrop of Legis Tor may serve to demonstrate the principle of a vermin trap. (see Plate 4:6) Five granite slabs are arranged to form a box, measuring 1.13m by 0.13m internally. A large basal slab is sunk level with the turf. The NE side is formed of one long slab set on edge and the SW side consists of two edge-set slabs placed on either side of a central gap, 0.17m wide. Three opposing pairs of vertical grooves have been incised into the granite: one on each side of the central opening and one at either end of the tunnel. This passage is covered by a slab, measuring 1.08m by 0.62m. The cover has three square-sectioned blind holes, 0.04m by 0.04m, arranged in a triangular plan, on the upper surface.

However, the remains give no indication of their operation, while traps were out of use by the time antiquarians and travellers recorded local customs. Richard Lavers, who worked at Trowlesworthy from 1841,

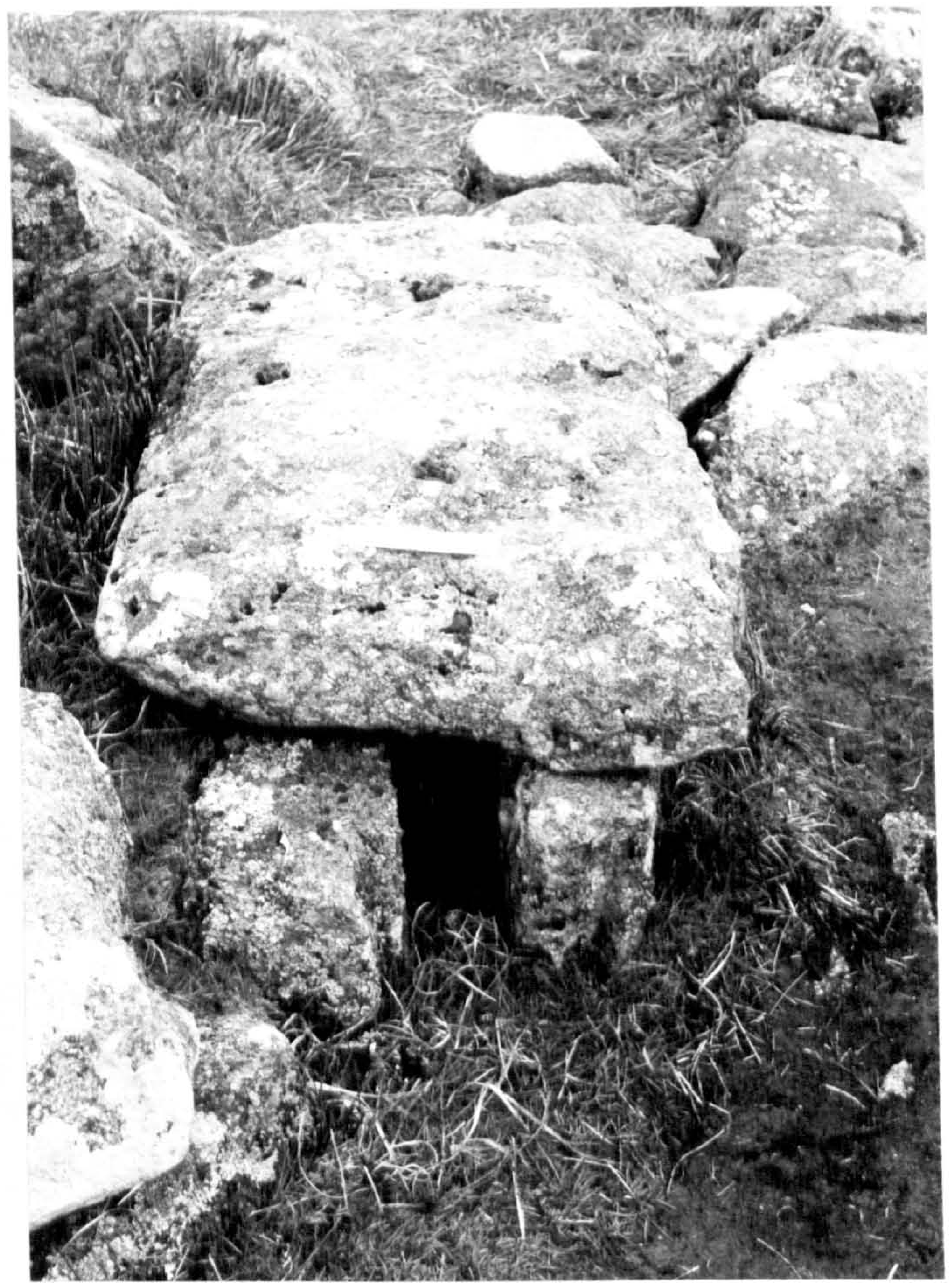


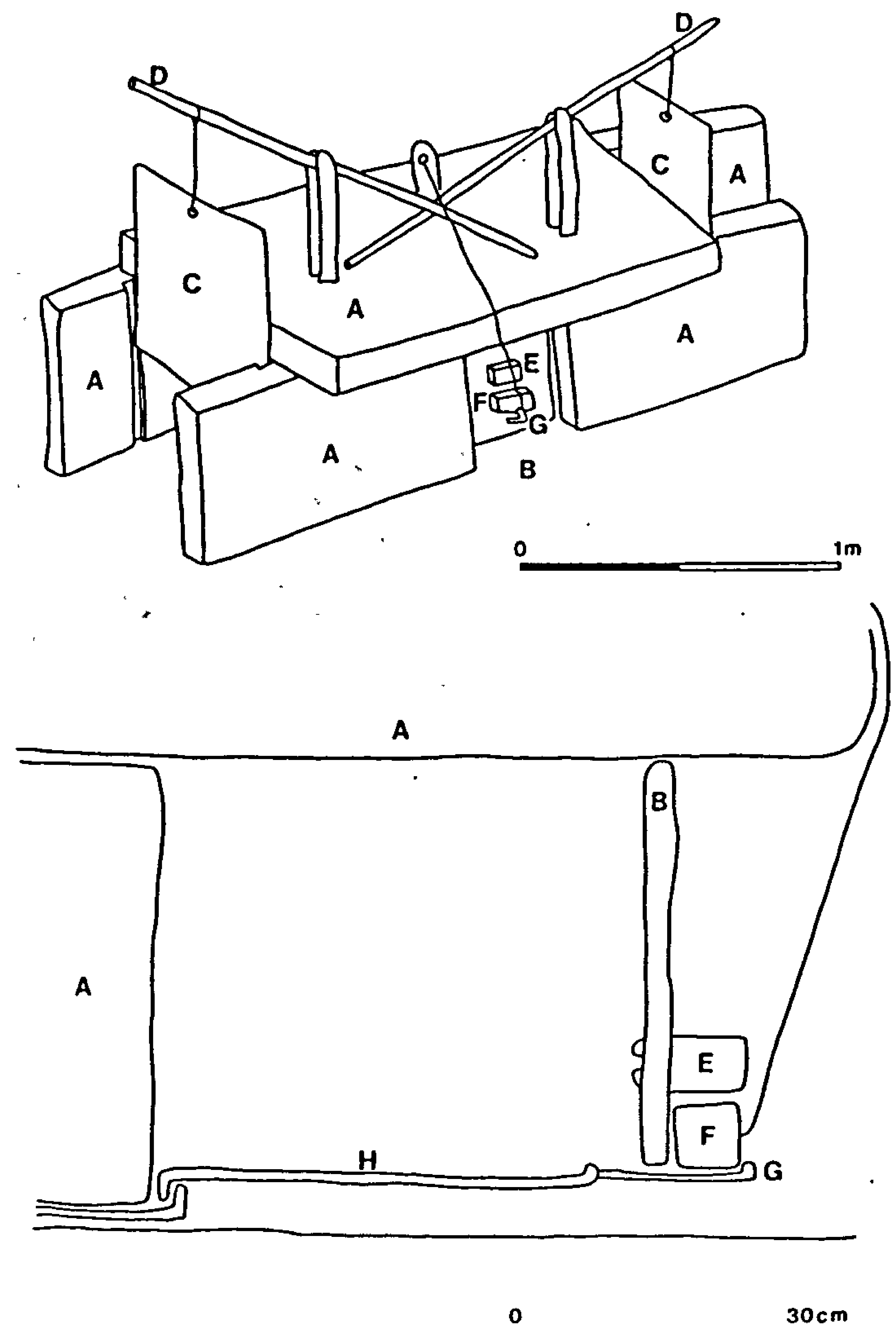
Plate 4:6 Vermin trap, **Mon X2**

knew the function of traps but did not know how they were set. (Worth 1944-5, 60) However, the principal can be elucidated from other models. Haynes has established that the Dartmoor vermin trap is a granite version of a long-used type of box-trap. (Haynes 1970, 149-150) In 1838 Lt.Col. Hawker illustrated a hutch-trap, with which he claimed his vermin-killer had over 30 years "caught more weasels, stoats, wild cats, rats and polecats, than any man in the county". (1838, 304) The material is not described, but the box seems to be made of wood. Another device, called a hutch, designed to catch polecats, was described by Mascall in 1590 (cited in Sheail 1971a, 61), while the same principle of imprisoning an animal alive by means of a trip-mechanism, was employed in medieval cage traps for mice. (Bateman 1971, 216) In consideration of the influence of the hutch-trap on Dartmoor vermin traps, it is interesting to note that the traps on Headland warren were known as hutches. (Haynes 1970, 162)

On the basis of Hawker's information and the discovery of remnants of the iron trip-mechanism at some vermin traps as well as fragments of slate, Haynes reconstructed a working model. (1970, 150) The operation of a vermin trap is illustrated in Fig. 4:2, but some particular features are worthy of comment. Firstly, the position of the trip-mechanism in the middle of the tunnel ensures that the victim is completely inside the box before the shutters drop. Secondly, the slate shutter in the side opening was kept permanently closed. The use of slate here was to provide a thin enough material to allow the tripping mechanism to protrude and catch the device holding the shutters in place. Presumably granite is too thick; no special provision was required in Hawker's wooden hutch-trap. (Haynes 1970, 150)

The other extant traps in UPV follow a similar pattern to **Mon X2**, though only one side survives at **Mons 695 and 738**. (Fig 4:4 and Plates 4:7,4:8,4:9 and 4:10) The internal length between shutters measures 0.70m at **Mon X1**, 1.09m at **Mon 738**, 1.18m at **Mon 639** and 1.30m at **Mon 695**.

Plate 4:7 Vermin trap, **Mon X1**



A Granite slabs

B Slate shutter , permanently closed

C Movable slate shutters sliding in grooves cut into granite slabs

D Wooden sticks held in position by tension of string attached to block **F**

E Plug permanently attached to slate shutter

F Block held in position between plug **E** and catch **G**

G Catch attached on inner side of slate **B** to metal plate which rests on floor of trap

When an animal treads on the metal plate (H) the catch (G) is displaced , releasing block **F** , and allowing sticks **D** and shutters **C** to fall

Fig. 4:2 The reconstruction of a vermin trap; elevation and section

Plate 4:8 Interior of vermin trap, Mon 639

Plate 4:9 Vermin trap, **Mon 678**

Plate 4:10 Vermin trap, **Mon 738**

The internal length of **Mon 678** cannot be measured but is presumably slightly over the length of the cover-stone: 1m. Haynes recorded internal lengths of 38 inches (0.97m) and 41 inches (1.04m) at two other traps in Legis Tor Warren and of 37 inches (0.94m), 41 inches (1.04m) and 33 inches (0.84m) at three other traps in Ditsworthy Warren. (Haynes 1970, 156)

A variety of methods controlling the rise and fall of the shutters is indicated by the different configurations of holes drilled on the cover stones. Haynes' solution for the purpose of these different configurations is illustrated. (Fig.4:3) While the coverstones of **Mon X2** and another trap recorded by Haynes in Legis Tor Warren had three holes, those of **Mons 639, 678 and 695** had two holes and that of **Mon X1** and a reused stone covering a drain at Ditsworthy Warren House had only one hole. (Haynes 1970, 156) (Plates 4:11 - 4:13) A horizontally drilled stone is set vertically above the traps, **Mons 639 and 738**, and presumably operated the shutters, as shown in Fig. 4:3. (Plate 4:14) The cover-stone of **Mon 738** is missing, but the similarity to **Mon 639** might suggest that it also had two holes. Haynes recorded another trap with a two-holed cover in Legis Tor Warren and one with a four-holed cover in Ditsworthy Warren. (Haynes 1970, 156) Yet another system is demonstrated by the unique arrangement at Headland warren. The one complete trap has a cover-stone without any holes, while both traps lack a side opening. Haynes suggests that shutters were operated by an apparatus suspended from the adjacent wall. (1970, 162-3; 154 Fig.50)

Hawker advised perforation of the shutters to allow light into the trap to dissuade the victim from gnawing its way out. (1838, 305) However, this eventuality would not arise in a granite trap, and shutters were probably solid. Two unperforated slates, complete with claw marks were found near **Mon 695** in Sheepstor Brook. (Cook 1964, 197, plate VI) Presumably, the traps were checked regularly so that any unintended victim could be released, though Hawker offers no advice on the removal of an angry stoat. Hawker advised that bait be left on either side of the trip plate to ensure that the animal stepped on it (1838, 305), and Mascall recommended the use of rabbit meat. (Sheail 1971a, 61) However, Haynes believes that bait was unnecessary if the trap was carefully located and provided with funnel walls. (1970, 152)

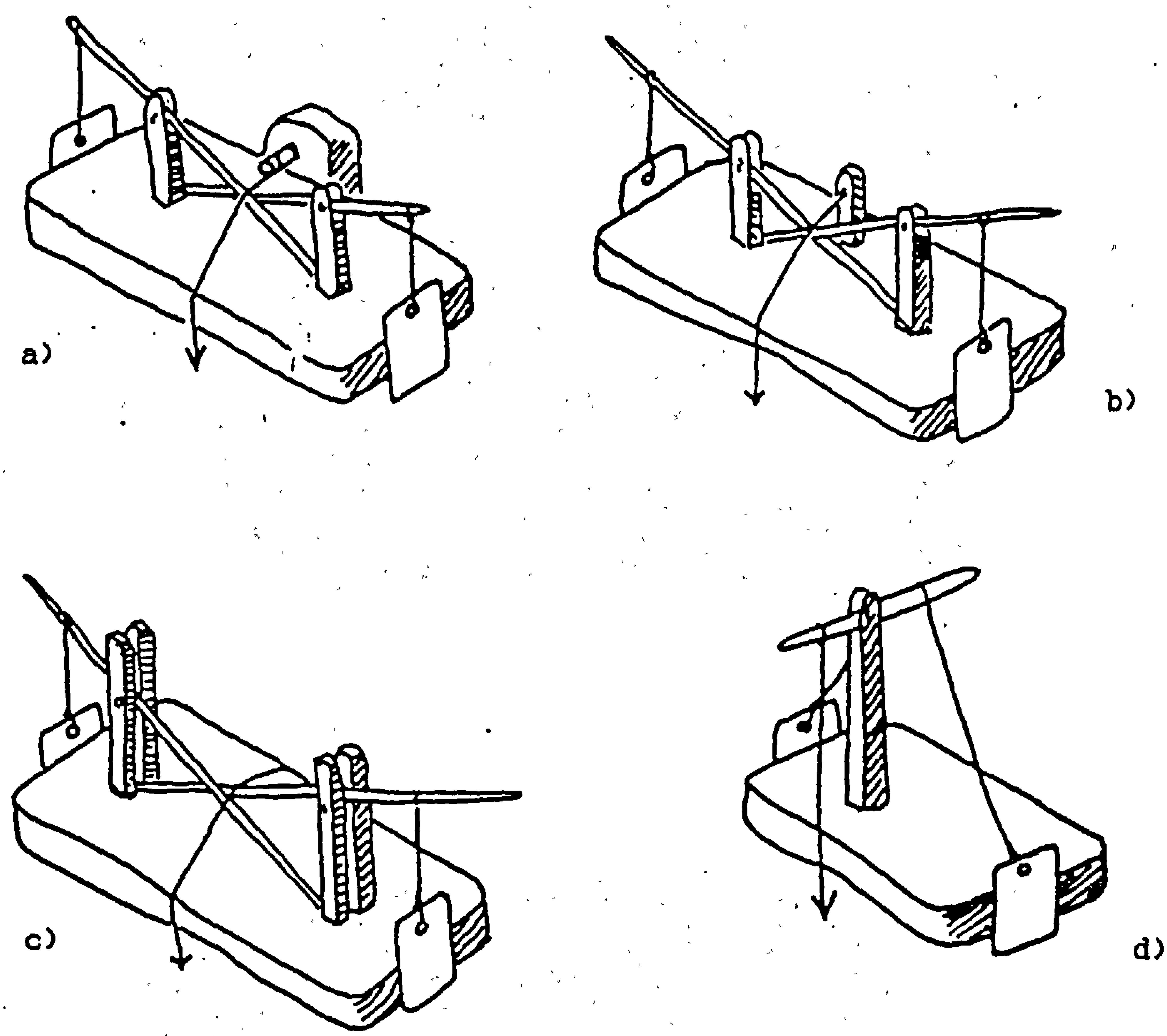


Fig. 4:3

The reconstruction of a vermin trap: alternative uses of the cover stone (from Haynes 1970, Fig 48)
a) Two-hole type, with string secured on holed side stone (eg Mons 639, 678and695)
b)Three-hole type (eg. Mon X2)
c)Four-hole type(recorded by Haynes at Ditsworthy No5)
d)Single-hole type (eg reused stone at Ditsworthy Warren House)

Plate 4:11 Cover stone of vermin trap, **Mon X2**

Plate 4:12 Cover stone of vermin trap, **Mon 695**

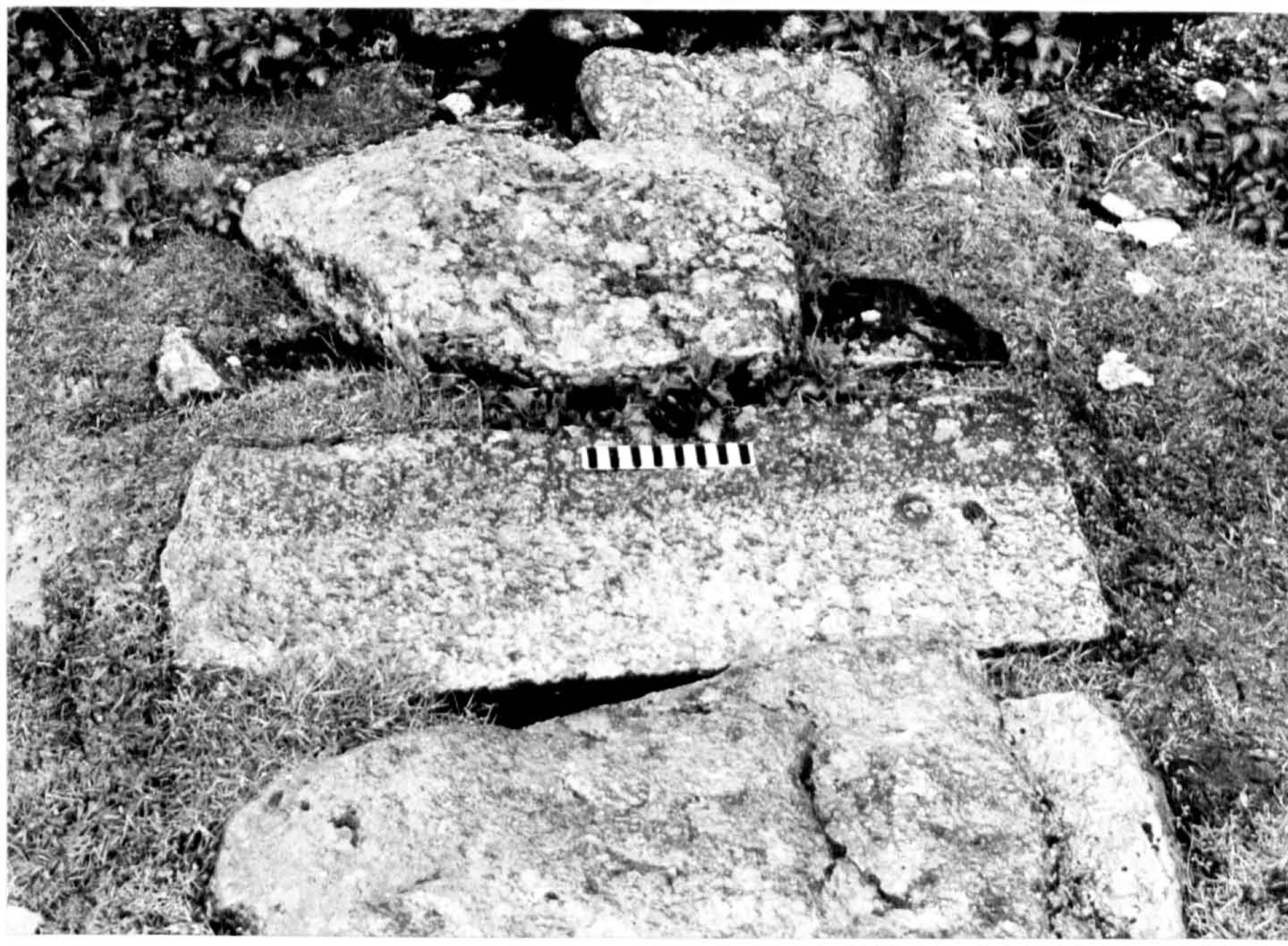


Plate 4:13
Re-used cover stone at Ditsworthy Warren House

Plate 4:14 Horizontally drilled stone above vermin trap, **Mon 639**

For the most part, it is the funnel walls, which indicate today the former existence of a trap. It is notable that only eleven out of a possible original total of 53 traps survive *in situ*. The flat slabs of the traps were probably too useful to be left , when the traps ceased to function. The reuse of a cover stone at Ditsworthy Warren House has already been noted; other examples have been recorded at Ditsworthy as well as at Headland Warren. (Cook 1964, 196; Haynes 1970, 161-2; Hemery 1983, 220) However, the great number of traps sites may not necessarily represent the number of traps. Haynes suggests that the funnel walls could have been abandoned and the traps re-located if a site proved unsuccessful. (1970, 155) Furthermore, the great number of funnel walls on Trowlesworthy Warren but complete absence there of any remains of traps suggests that wooden traps may also have been used.

Funnel Walls

Without bait some other means is required to entice the prey into the trap. A funnelling effect was achieved by the construction of low walls extending outwards from either end of the trap. The walls can consist of loose rubble or carefully-constructed coursed masonry or facing stones. The plan of the walls also varies. (Figs 4:4 and 4:5) The absence of the trap at the intersection of the funnel walls makes interpretation very difficult without prior knowledge. Their frequent positioning next to or across prehistoric enclosure walls adds to the confusion and may explain Spence Bate's interpretation of them as elaborate military entranceworks. (Spence Bate 1870-1, 501-2) The Rev. Bray was similarly bewildered by the X-shaped funnel walls, which he observed in 1802 on Sheepstor:

> "On returning for our horses, we discovered near the top of the Tor two stone ridges, almost covered with turf, that intersected each other nearly at right angles, and formed a cross. In the middle was a flat horizontal stone. Measuring from this central point, the ridge to the east was twelve paces, west six, north seven, and south eleven. We afterwards discovered a larger one below, at the south side of the Tor. At first we conjectured they were sepulchral monuments; and afterwards thought they might have been folds for sheep" (Bray 1838, 234)

Cook classified vermin traps according to the plan of the funnel walls. (1964, 192 Fig 1) The funnel walls in type I are arranged in a simple X-shape. Type II consists of a type I arrangement set across an existing wall. The V-shaped funnel walls of types IIIa and b also rely

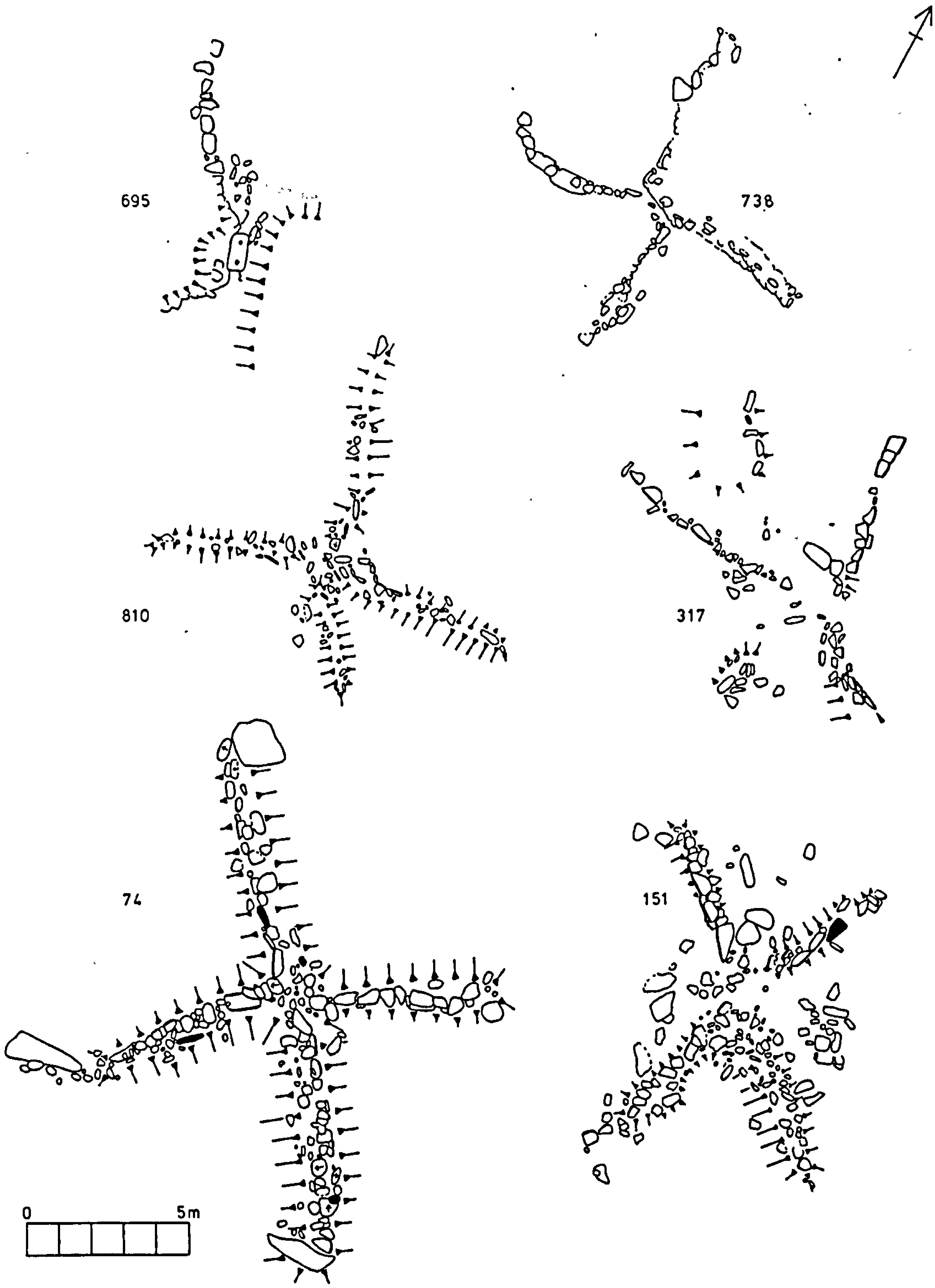


Fig. 4:4 Vermin traps: plans of funnel walls

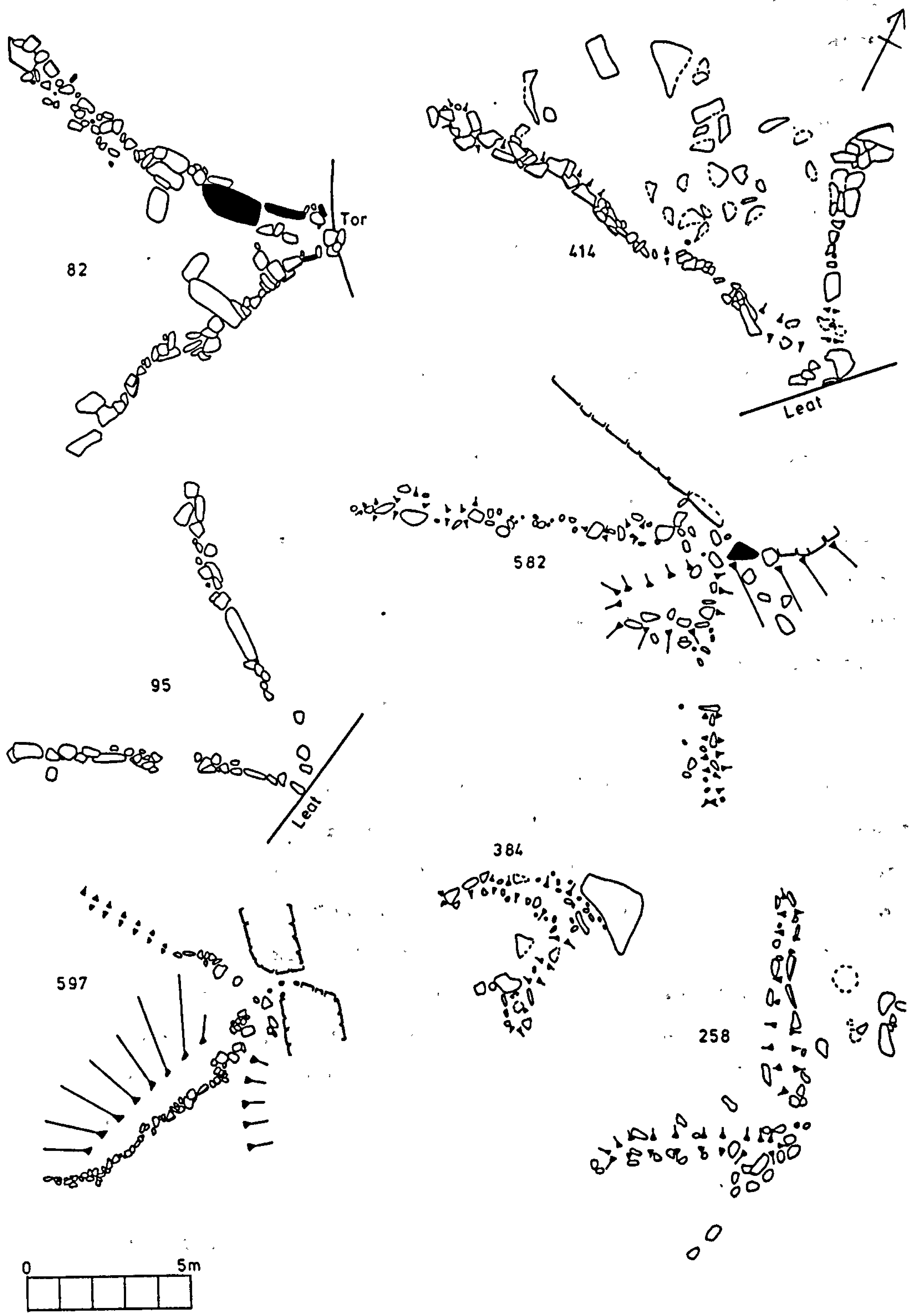


Fig. 4:5 Vermin traps: plans of funnel walls

on an existing wall; in type IIIa the trap rests against the wall, while in IIIb the trap is set at a gap through the wall. Type IV also guards a gap but lacks funnel walls. However, Haynes lessens the significance of the wall plan believing surely rightly that the layout of the walls is dictated by the site of the trap. (1970, 152) The critical factor in the construction of a vermin trap would certainly appear to be its location, and the plan of the walls depends on its relation to existing walls or structures, though it could be argued that certain situations warrant a particular configuration.

A trap without bait has to be placed on a pathway likely to be used by vermin. An ideal location would be a narrow route between obstructions; funnel walls could be constructed to completely enclose the route so that the tunnel is the only option. Traps were probably left open for a while, before the trip mechanism was set, so that animals became accustomed to them. Trap, **Mon 695**, fitting neatly between two tinners' heaps in N Gutter Mire is a good example and funnel walls are hardly necessary though the heaps have been faced with stones, forming a plan similar to Cook's type I.(see fig 4:4)

Traps set beside large or long obstructions, such as a tor or enclosure wall might be similarly effective as animals tend to follow the obstruction until an opening is found. Thus **Mon X2**, at the base of an outcrop of Legis Tor and **Mon 384** at Little Trowlesworthy Tor, are ideally placed to catch an animal skirting the tor, amongst cover of clitter. Similarly, the series of vermin traps, **Mons 95, 413 and 414** against leat **Mon 47**, and **Mon 582** against a long tinners' wall, **Mon 580b**, would catch animals looking for a way through. These would correspond to Cook's type IIIa, though **Mon X2** is X-shaped in plan and actually equates with Cook's type I.

Another useful location would be at a gap in an existing wall. The use of prehistoric or later enclosures would minimize the effort required in placing the trap, though additional funnel walls could guarantee success. Cook's types II, IIIb and IV would all serve this function, and examples in UPV are represented by **Mons 350, 351 and 810. Mons X1 and 639** are the only vermin traps in UPV without funnel walls, corresponding with Cook's type IV. They guard tunnels through walls, Mons 739 and 630a, respectively.

Vermin traps occur on four other warrens on Dartmoor but in much smaller numbers. Thus, three are recorded at Sheepstor and at Vaghill. (Haynes 1970, 161-4) The four traps at Huntingdon are all situated along or within the Broad Falls - Gibby Beam wall, which, as suggested above, may pre-date the 1809 warren extension and, therefore, allow a pre-19th century date for the traps. (Haynes 1970, 163) Two traps were recorded at Headland by Haynes (1970, 163-4) and another one by Hemery (1983, 645) and Brewer (1986b, 23). A further one may be that found by Woods on the W side of Walla Brook. (1986, 18) He suggested that it belonged to New House Warren and. therefore, was relatively late in date. However, its position immediately next to the boundary with Headland suggests that it could still belong to the latter warren. Remains of a trap in the S perimeter wall may have come from this site or a fifth trap. (Brewer 1986b, 23)

However, the number of remains of vermin traps in Dartmoor contrasts with the absence elsewhere in Britain, though church warden's accounts attest the killing of vermin all over the country. It is probable that wooden traps were employed, which subsequently decayed or were removed. These may have been used with bait or with funnels made of more perishable material than stone. It is also likely that the distribution may be concentrated on Dartmoor because of the assiduous fieldwork by Cook and Haynes. Earthwork examples have been discovered at Minchinhampton Common, near Stroud, Gloucs. and at Bryn Cysegrfan, Llanfair Clydogau, Dyfed. (Aston 1985, 116; Austin 1988, 141,149-150), Possibly others are eroded or lie unrecognized. Some stone funnel walls have also been recorded, for example at Worlebury and Dolebury warren, N and E of Weston-Super-Mare respectively and Avebury, Wilts. (Worth 1944-5, 61; Aston 1985, 116)

<u>Date of Vermin Traps.</u>

It has previously been difficult to ascertain the date of construction, and period of use, of vermin traps. Cook suggested that the frequent use of tinners' waste heaps precluded a *terminus post quem* much before 1700. (1964, 197) Further, it seemed likely that they were out of use by the early 19th century. Thus people acquainted with traps in the early 19th century, such as Bray and Lavers did not know how they worked. Further, many trap stones show signs of having been split by the 'feather and tare' method, which was largely displaced by the drill by 1820. (Cook 1964, 196) The presence of vermin traps, **Mons 95, 413 and 414** built against the leat, **Mon 47** which was dug out for the Bottle Hill Mine, suggests a post-1825 date. However, the work undertaken in 1825 seems to have involved the clearing of an old channel (see Table 5:8), parts of which are still preserved as **Mon 436**, so that the vermin traps could have been built against it at an earlier date.

However, parish records provide strong evidence that vermin traps were introduced, at least to Sheepstor parish, in the 1740's and went out of use in the early years of the 19th century. An Act of 1565-6 authorized churchwardens to levy a tax from farmers to be paid "for the destruccion of noyfull Fowles and Vermyn", though subsequently the payments were generally made from church funds. This Act stipulated the bounty of 1d

> "for the head of euery Fitchewe, Polecatte, Vesell, Stote, Fayre Bade or wylde Catte". (quoted in Brushfield 1897, 294)

Thus church wardens' accounts record bounties paid from parish funds for the eradication of any vermin liable to damage crops, livestock or game. In many records there seems to be no distinction between stoats, weasels and polecats and all are grouped together as 'fitches'. In Hartland parish, NW Devon, where records survive from c.1600, the largest group of vermin destroyed was the fitch; payments of 1d - 2d were made for an average of 20 fitches a year, which amounted to 3,061 by 1750. (Pearse Chope 1940, 177) Although a few stoats were also accounted for, the small number suggests that they were normally included as fitches. There are also a few payments for pine martens; a 'martyn' and a 'marteil' were recorded at Okehampton in 1780 and 1787 respectively. (Brushfield 1897, 318) Pine martens may have been more of a problem off the moor. A payment of 1s each was given for 122 'martrill' between 1725 and 1750 at Hartland. (Pearse Chope 1940, 177)

Of greatest significance for UPV is the evidence in the surviving church wardens' accounts for Sheepstor parish, which date from 1718. (DRO PW1,PW2) These record a very small number of payments for fitches in the early years of the 18th century but a dramatic increase during and after the five-year period 1745-49. (Table 4:2) Thus between 1718 and 1744, only eight fitches were recorded and these were all in 1723. (DRO PW1) This contrasts with the large numbers of payments for fitches made from the 1740's, starting with 24 fitches in 1749 and 46 fitches and 12 stoats in the period 1750-54. Payments continued until 1802, accounting for a total of 410 fitches, 12 stoats and 43 fitches or stoats. Some years were particularly successful; thus payments were made for 34 fitches and stoats in 1753, 32 in 1757, 36 in 1784, 36 in 1801 and 39 in 1802.

The sudden increase in the 1740's may be attributed to a concerted effort at eliminating the fitch, which may have become a particular problem at that time. Alternatively, it may simply reflect the more regular payment of bounties by the parish. However, the latter would probably have occurred because the fitch had become a serious pest. Whatever the reason, it is most likely that the sudden appearance of a large number of payments for fitches coincides with the introduction of vermin traps.

It may even be suggested that the Legis Tor and Ditsworthy traps date to the 1770's, when the first payments were made to John Nicholls, the warrener. Subsequently it is notable that the largest number of fitches in each year were caught by the warreners. Thus payments for one or two fitches were made, for example, to Simon Willcocks of Nattor in 1786-88, while 14 fitches were trapped by John Nicholls in 1771, eight in 1772, ten in 1773 and 13 in 1774, and a total of 63 between 1771 and 1781. Richard Northmore was paid for a total of 90 fitches between 1780 and 1796, including 36 in 1784 and 19 in 1786.

On account of the sudden end to payments for fitches after 1802, it may also be suggested that vermin traps went out of use around that date. It cannot be assumed that the last trap was set in 1802. It is more likely that payments were last paid in that year. However, cessation of bounties presumably reflects the success of the eradication and fitches may no longer have been a serious problem. Vermin traps may no longer have been required but a few fitches may still have been trapped on the warren after that date.

Table 4:2 Payments made for the destruction of Vermin.

Sheepstor Parish - Church wardens Accounts. 1718-1831.

DATES	FOX	YOUNG FOX	FITCHES	STOATS	OTTER	BADGER	OTHER
1718-19	1	5	-	-	-	-	-
1720-24	1	2	8	-	-	-	1 hedgehog
1725-29	-	-	-	-	-	1	-
1730-34	6	-	-	-	-	-	-
1735-39	12	8	-	-	-	-	2 "Cobes"
1740-44	5	7	-	-	-	-	-
1745-49	3	9		24*	-	-	-
1750-54	7	-	46	12	2	3	-
1755-59	3	4	32	19*	1	2	-
1760-65	7	1	-	-	4	2	-
1765-69	5	6	3	-	2	6	-
1770-74	5	2	54	-	1	4	-
1775-79	5	8	33	-	-	5	-
1780-84	3	5	76	-	-	2	-
1785-89	1	-	64	-	1	8	-
1790-94	1	-	18	-	-	2	12"Varments"
1795-99	6	-	1	-	1	-	3"Varments"
1800-04	7	-	75	-	1	1	-
1805-09	14	-	-	-	-	-	-
1810-14	4	1	-	-	-	1	-
1815-19	5	-	-	-	-	1	-
1820-24	7	-	-	-	-	1	-
1825-29	5	7	-	-	-	-	-
1830-35	4	-	-	-	-	-	-

* Recorded as "Fitches and Stoats".

It is also acknowledged that, in the early 19th century, vermin traps were replaced by other methods. By the 19th century spring traps were widely used against vermin, though the danger to rabbits may have precluded their use on a warren. Vermin traps were more likely to have been superceded by the shotgun, which was available for general use after about mid-18th century. Haynes suggests that latterly vermin on Dartmoor warrens were shot from ambushes. (1970, 155; 1979a, 57) Natural clitter around tors would provide ample cover, though it is possible that a group of boulders at Legis Tor has been artificially arranged to form a hide.

As well as protecting the warren population, the trapping of vermin also contributed in a small way to the warreners' income. Sheepstor parish paid the usual reward of 2d for a fitch, which is considerably lower than the bounties paid for other predators, such as 5 shillings for a fox, 2s 6d for an otter or one shilling for a badger. Nevertheless, it compares not unfavourably with the late 19th century price of 9d for a rabbit.

Furthermore,these payments may not have been the only financial benefit; the stipulation in the 1565-6 Act that heads were to be destroyed suggests that the trapper may have kept the rest of the animal. Thus as well as the bounty additional income may have accrued from the sale of pelts. Warreners already acquainted with the fur trade would have had no difficulty in disposing of skins, which fetched a higher price than rabbit. After the 15th century pelts, of the weasel family, but particularly pine marten, were increasingly fashionable. (Veale 1966, 134) Although N European skins, such as sable, ermine and lettice were favoured, the demand for native pelts may have increased because of the decline in foreign trade in the 15th century, and high prices at home and abroad in the 16th century.(*op.cit.*, 161) However, by the 16th and 17th centuries the fashion for fur was waning (*op.cit.*, 179), and possibly vermin skins were sent with rabbit skins for the manufacture of felt. Whatever their ultimate use, skins of vermin were still being sold in the last days of Trowlesworthy warren. (Haynes MS)

b) Foxes.

Although they have made no impact on the archaeological record other predators may be mentioned here. Next to polecats, stoats and weasels the fox may have been the warrener's major enemy. The wiliness of the fox may have warranted a different approach from other vermin. From the late 18th century, fox hunting with horses and hounds was the common remedy. The Dartmoor Hunt, established *c.* 1827 may have served UPV, while the Mid-Devon Hunt covered W Dartmoor. (St.Leger-Gordon 1950, 306-7) Foxes were clearly a problem in the mid-20th century; the Dartmoor pack was able to hunt four days a week at the beginning of the Second World War. (*ibid.*) A modern density of three to four per square mile, rising seasonally and regionally, has been estimated. (Harvey and St.Leger-Gordon 1953, 85)

However, this was not always the case; the release of French and Scottish foxes on Dartmoor for hunting in the 19th and early 20th centuries may indicate a scarcity. (Hurrell 1971a, 64) Whether this scarcity has a long history is unknown. It has been suggested that the high price paid for foxes from church funds indicates rarity. (*ibid.*) Thus at Tavistock the price on a fox's head rose from 1s in 1566 to 3s 4d in 1673. (Brushfield 1897, 305) In the 18th century, 3s 4d was paid for male foxes and 6s 8d for vixens at S Tawton and Okehampton. (*op.cit.*, 306) However, it could equally be argued that this high price reflects the difficulty of catching the cunning fox, as well as the amount of damage it could do. Although fewer foxes were caught than fitches, an average of seven *per annum*, amounting to 1,415 individuals, as well as those paid for in bulk, were accounted for over *c.* 200 years in Hartland. (Pearse Chope 1940, 176) Records from E Budleigh parish, from 1664 to 1835, demonstrate a regular annual total of under ten. (Brushfield 1897, 344-5) However, in Sheepstor, a total of 182 foxes were caught from 1718 until bounties ceased to be paid after 1831, amounting to an average of only three foxes every two years. 5 shillings was the normal bounty for an adult fox and 2s 6d for young. Occasionally larger sums were paid; for example, 6s 9d was paid to Edward Mead "for killing an old Vixen great with young". (DRO PW1)

Before the organized hunting established in the late 18th century, packs of dogs may still have been the most effective method of catching foxes. References in parish records to fox-catchers and huntsmen suggest that certain individuals specialised in this activity and presumably travelled as necessary round the parish. Thus, in 1652-3 in Hartland parish, "James Barefoote the fox-catcher" was paid £4 for his services and in 1601-2 1s was paid to "Mr Coffins Huntsman" for one fox. (Pearse Chope 1940, 176) Similar references appear in the Sheepstor accounts. Thus, in 1755, 2s 6d was paid for one fox to "Esqr Trebys Huntsman", while 5 shillings was paid for an old fox in 1777 to Mr Radger's huntsman. Similarly, "Mr Bulteel's Huntsman" was paid 5 shillings for a fox in 1771, 1774 and 1780. (DRO PW1)

Occasional payments to a "wariner" in the Hartland accounts between 1620 and 1630 indicates success on a warren, or possibly a game preserve. (Pearse Chope 1940, 176) In Sheepstor, as in the case of fitches, it was again the warreners, who were particularly assiduous hunters of foxes. John Nicholls Senior and Junior accounted for over half of the foxes, for which the bounty claimant is named; between 1736 and 1781 they killed at least 41. Edward Mead was paid for eight foxes in his last years at Ditsworthy and Richard Northmore was paid for six foxes in 1796. (DRO PW1) Like the professional huntsmen, the warreners probably also relied on dogs. The warreners' success continued into the later 19th century; Crossing relates how the Lavers at Trowlesworthy outwitted a fox, which had been preying on the warren's poultry. (Le Messurier 1966, 59-60)

Apart from dogs, traps may have been used; two fox traps were bought for £1 by Hartland parish for loan as required. (Pearse Chope 1940, 177) Finally by the 19th century, in the absence of a hunt, the shotgun may have been the answer. Brushfield records the practice, in N Devon in the early 20th century, of ringing the church bell to call out the villagers when a fox was sighted. (1897, 307)

c) Other Predators.

Finally, the warrener may have dealt with other, probably lesser, dangers according to necessity. Bounties were paid for 39 badgers and 13 otters in Sheepstor parish between 1718 and 1831. The majority of the payments are recorded between 1750 and 1800 and, therefore, coincide with the concentration of fitch bounties. This suggests a particularly intensive campaign of vermin destruction in the second half of the 18th century.

Badgers could be dug out and captured with the aid of terriers and 'badger tongs', a device, which restrained the animal around its neck. (Ingram 1978, 28) Again warreners were involved; in 1728, William Nicholas [Nicholls] received one shilling for "a gray" [badger] and, in 1760, "John Nickles" was paid one shilling for a badger and 6 shillings for two otters. (DRO PW1) The badger bounty was paid to Richard Northmore in 1782 and to "Mr Northmore's boy" in 1771. Indeed, the capture of badgers may have been a particular duty of servants; "Mr Willcocks boy" in 1771, "John Crap's servant" in 1774 and "Mr Willcocks servant" in 1775 also received the bounty.

Finally, birds of prey may have been tackled, though there is no record in the Sheepstor accounts. Crow-nets were kept by each parish and may have been baited to entice the birds. For example, in Minchinhampton parish, 2s 4d was paid "for a crowe nett" in 1575.(Brushfield 1897, 327) This device may also have dealt with buzzards, which seem to be included with kites; these fetched 2d from some parishes in the 17th century.(*op.cit.*, 330) The warrener may also have tried to combat winged predators by providing shelter in the form of gorse bushes.

d) <u>Poachers.</u>

It may also be appropriate at this point to consider the threat from poachers, though they have left no mark on the archaeological record. As long as the modern rabbit has been established in this country, it has been a target for poachers. As early as 1268, Richard, Earl of Cornwall complained that his coney warren at Isleworth, Middlesex had been broken into. (Veale 1957, 87)

Strong measures were taken by successive kings to protect their hunting in royal forests and under successive legislation the right to take rabbits became entrenched in rights of property. (Worrall 1956, 199) In 1389, an Act of Parliament restricted the killing of rabbits and "other gentlemen's game" to persons with property qualifications. (*ibid.*) The penalty of loss of life or limb was revoked in Henry III's charter of 1217 (Spooner and Russell 1967, 329), but harsh sentences remained and the 18th century game laws were particularly severe. (Sheail 1971a, 118)

In 1765, transportation for seven years, whipping, a fine or imprisonment could be the result of stealing rabbits at night. (*op.cit.*, 62)

However, by the 19th century, penalties were reduced; the severity of sentences for catching rabbits may have posed a problem for the punishment of dog, sheep or horse theft. (*op.cit.*, 119) However, the number of laws was far from reduced and a plethora of legislation, including the 1828 Night Poachers Act, the 1831 Game Act, the 1844 Night Poaching Act and the 1861 Larceny Act, was introduced possibly to clarify what had been a confused situation. (Harting 1898, 58, 159, 166-7)

However, poaching remained a recurrent problem to the keepers of both sporting and commercial warrens and the vigilance of the warrener was probably the most effective deterrent. The presence of a permanently occupied house on moorland warrens, such as Trowlesworthy and Ditsworthy warren houses in UPV must have provided some discouragement. The construction, at Huntingdon warren, of a small shelter on the West side of the hill was intended to protect that part of the warren, furthest from the warren house. Crossing discovered the necessity of such a precaution in conversations with turf-cutters, formerly [ie.mid-19th century] employed at Redlake Mires, West of the warren:

> "when their supplies of food were running short, or they desired a change of diet, they made incursions into Huntingdon Warren. Men who worked there have told me of the large number of rabbits they have seen prepared for supper". (1912, 372)

Warreners could combat poaching by looking out for snares, scattering loose thorns or gorse to entangle long nets (discussed below p. 318) or by setting traps. (Harting 1898, 152-4 : Ingram 1978, 29-30) Two man-traps were kept at Ditsworthy and one was displayed on top of the bull ring next to Sheepstor church in the early years of this century. (Haynes 1970, 155 : Breton 1911, 30)

4.4 THE MANAGEMENT OF THE WARREN

Documentary and anecdotal evidence can throw light on the management of warrens, which, in turn, has some implications for the field evidence After securing the boundary, constructing pillow mounds and guarding against vermin and poachers, the main concerns of the warrener would have been to preserve the quality of the grazing, maintain a steady population of rabbits, "harvest" them and transport them to market.

4.4.1 Care of Pasture.

It was an adequate food supply, which Simpson regarded as the most essential element in the management of a warren; "high culture of the pasture will keep many rabbits 'at home' without enclosing" (1895, 90). While he accepted that some rabbits would still escape, he stressed the need to care for warren pasture. Attempts were made to improve pasture by excluding rabbits from small plots, on which a rotation of crops, such as clover, oats or beans, was grown and then re-seeded with grass before re-introducing the rabbits. (Harting 1898, 64) However, Simpson observed that alternate cropping of divisions of the warren was not worth the effort of enclosing separate plots. (1895, 107)

Of greater significance is the need to counteract the habitual nature of the grazing pattern. Simpson observed that a black rabbit in his experimental plot grazed in the same place every day. (1895, 73) Further, while rabbits have been known to cover four miles daily in search of water in Australia (Thompson and Worden 1956, 104), in Britain they rarely venture beyond a maximum of 400m from the burrow. (Tittensor and Lloyd 1983, 16; Thompson and Worden 1956, 217 table X) In addition, when feeding commences they tend to start grazing immediately outside the burrow before venturing further, and in bad weather may go no further at all. (Thompson and Worden 1956, 68) This suggests that an even distribution of burrows is of paramount importance. (Simpson 1895, 75)

Finally, by the 19th century observations were increasingly made that warren land became 'rabbit-sick' or less fertile. While over-grazing probably played a considerable part, the tainting effect of partially decomposed droppings also contributed.

Some measures may have been taken to protect pasture on UPV warrens. Thus, an effort seems to have been made to distribute pillow mounds evenly throughout the warren. Distribution may have been affected by natural and man-made features. The difficulty of excavating mound material and the prevalence of vermin would have precluded the areas of heavy clitter, while pre-existing field systems, notably that on Hentor Plain, may have influenced the siting of pillow mounds. However, while some mounds have been built in closely-spaced groups, possibly for specific reasons, in general, the pillow mounds seem to be well-dispersed over the pasture. The pillow mounds in Ditsworthy Warren are particularly evenly distributed.

Furthermore, the warreners made considerable efforts to drain the pasture. Numerous ditches run down the slopes of Trowlesworthy and Legis Tor warrens, such as **Mons 49, 50, 254, 370 and 398**. Others curve round to protect groups of buries, for example **Mons 212, 357 and 388**, though in the process these would also have kept grazing dry.

Extra fodder to supplement the rabbits' diet over the leanest months, would also have protected the pasture from over-grazing. A supply of hay may have been brought in, but possibly only enough for emergencies. Additional fodder was particularly necessary in snow as rabbits are not equipped to easily clear snow away from underlying vegetation. Hay could also be grown on the warren; some of the enclosed fields in UPV, **Mons 130a** at Trowlesworthy and **Mons 880c and d** at Ditsworthy were designated "meadow" on the Tithe Maps of 1840-43 and were presumably for the cultivation of grass for hay. The practice continued into the 20th century; Eric Hemery recalls his first encounter, shortly after the Second World War, with Robert Giles of Trowlesworthy, when the latter was scything grass in one of the "enclosed fields near the river bank", possibly **Mon 183**. (Hemery 1983, 221) Ditsworthy Warren also had a haymow, **Mon 880k**, called a "mowhay" on the Tithe Map, for the storage of hay.

Green shoots of gorse or furze were also enjoyed by rabbits. Twelve large waggon-loads were brought to one Breckland warren one winter (Sheail 1971a, 50), but furze could also be grown on the warren, where it had the added advantage of providing shelter. Haynes claimed that, in the absence of many pillow mounds on Headland Warren, the rabbits were kept in high-walled enclosures planted with gorse: two next to the warren house and four, known as the "Four Aces" or "playing card platts", to the W of the warren. (Haynes 1970,162) Alternatively, Brewer argues that, because the enclosures have evidently been built to exclude rather than contain rabbits, they may have been primarily for the cultivation of gorse or hay for fodder, while the numerous tinners' waste heaps provided adequate accomodation for rabbits. (Brewer 1986b, 22) The latter may be more likely, though it should be remembered that an enclosure can be used later for a different purpose than originally intended, such as occurred with the western boundary of Ditsworthy Warren, **Mon 624b**. A further use of the enclosures in catching rabbits is recounted below. (p.324) The nutritional value of furze was thought to compare well with swedes, turnips and cabbages. (Simpson 1895, 79) However, it may have been difficult to establish artificially. The last warrener at Trowlesworthy lamented to Haynes that he had been unable to grow gorse successfully. (Haynes 1979a, 56)

After 18th century improvements, turnips became increasingly popular, and a neighbouring farmer recorded the growing of turnips in the playing card platts at Headland Warren. (Wilkinson 1986, 18)

However, the maintenance of a good quality of herbage throughout the year depends to a great extent on the size of the warren population. Among graminivorous animals, rabbits graze closest to the ground; grass is cropped to within less than ½ inch of soil.(Thompson and Worden 1956, 98) Under intensive grazing, the rabbit's favourite species disappear, while trampling feet and disturbance of the surface encourages weeds. (Sheail 1971a, 54; Thompson and Worden 1956, 100) Thus on islands off the Pembrokeshire coast in the 1940's and 1950's, the good quality grasses, notably red fescue on the rabbit-free Grassholm contrasted with the poorer quality species, such as thrift, Yorkshire fog, bracken and ling on adjacent rabbit-infested Skokholm. (Thompson and Worden 1956, 100) In extreme pressure, grass is replaced by moss or lichen, while in areas with dry, light soils, overgrazing can lead to desiccation and eventually erosion. In this way, in the 17th century, wind-blown soil from Lakenheath warren, Suffolk covered thousands of acres as far as Santon Downham, Norfolk, a distance of *c*.5 miles. (Sheail 1978, 350)

However, a controlled rabbit population can improve pasture; steady grazing can create an even short-cropped turf, the rabbit's own preferred habitat. (Tittensor and Lloyd 1983, 8) In order to maintain good quality pasture, maintenance of an optimum population is critical. The warrener must have aimed to balance a winter population low enough to survive on poorer herbage over the winter months, with a summer population high enough to cope with the fast growth of grass in spring. The abundance of grass in spring and early summer coincides with the breeding season and the resultant maximum natural population may have been sufficient to crop the lush vegetation. Simpson warned that insufficient grazing would produce tussocky, rank herbage, unsuitable for rabbits. He advised the introduction of other grazing animals for a short period if the rabbit population was too low. (1895, 77)

4.4.2 Control of Population.

In addition to protecting the pasture, a careful control of population was required to maintain a steady breeding colony. Many leases stipulated the size of the breeding population to be left at the end of the tenure. Thus 3,000 adults were to be maintained at Ellingsdean warren in 1583, and at Micheldever, Hants. in 1649, the warrener contracted to keep 1,000 couples. (Sheail 1971a, 44) In UPV, the 1857 lease for Ditsworthy required the maintenance of 3000 couples of breeding rabbits. (Hemery 1983, 218)

The number of rabbits per acre varies regionally and seasonally. Simpson demonstrated that one acre could feed up to 100 rabbits (250 per ha.) but this was a single experiment and not designed to produce a breeding colony.(1895, 56) Uncontrolled, rabbit densities can reach high figures; peak summer densities of 10 to 50 per hectare were recorded on the British mainland in the 1950's, while on islands, such as Skokholm, numbers reached 100 per hectare. (Tittensor and Lloyd 1983, 7) However, the critical factor is the size of the breeding colony left at the end of the winter. This varied from two to eight rabbits per acre (5-20 per ha.) on most warrens. (Sheail 1971a, 57)

A strong breeding nucleus ensured continued success of a warren and overkill may have contributed to the failure of some warrens. One agent left only one doe to two or three acres for breeding. (*op.cit.*, 45)

Caution was required to prevent too great a reduction of population as restocking incurred considerable expense, though the occasional introduction of new blood may have been a common and beneficial practice. (Harting 1898, 40) Thus, in 1724, £400 was the estimated cost of "planting" the warren at Driby and Calceby, Lincs. with 1,000 couples. (Sheail 1978, 345) Conversely, care was needed to prevent over-population from triggering the rabbit's natural breeding controls.

Therefore strength of the population as well as quality of pasture depended on careful culling procedure. To build up numbers, netting and trapping ceased in Spring. Crossing (Le Messurier 1966, 62) suggested that on Dartmoor the trapping season lay between late summer and early spring. This coincides with the main breeding season, which runs from January to September but is concentrated between February and May. (Lockley 1965, 137; Thompson and Worden 1956, 41-3)

A closed season would allow a new generation to grow. However, once trapping resumed in the autumn, the latest offspring would still be small; in its first winter between the ages of six and twelve months, a rabbit weighs one-third less than the fully-grown 18-month old rabbit. (Lockley 1965, 137) Young rabbit was regarded as a delicacy (Simpson 1895, 35) but the skin, at least, of smaller specimens probably fetched lower prices, and it may have been desirable to cull only mature rabbits. Therefore it is possible that a netting procedure was designed to achieve this.(see below p. 320) A similar procedure may have been followed to maintain a suitable ratio of males to females. Simpson claimed that females produced litters more freely when bucks were fewer (1895, 22) and a surplus of males was considered unnecessary and wasteful for breeding purposes. (Sheail 1971a, 58) Recommended ratios of male to female varied from 1 : 3, to 1 : 10 (Simpson 1895, 81 : Wilson 1845-6, 443) The ratio of 100 male to 107 female births seems unlikely to produce such figures in the adult population. (Lockley 1965, 142) Again discriminate netting may have been used (see below p.320) though it is possible that a ratio of one male to several females would occur naturally in the wild. In a controlled experiment using a small number of rabbits, it was observed that weaker males were intimidated and driven away by a dominant male, who proceeded to control a territory and a number of "concubines". (Lockley 1965, *passim*)

4.4.3 Catching.

The method of catching rabbits in the UPV in the 20th century is well-documented. Crossing, Haynes and Hemery were all acquainted with the warreners and recorded the activities of the Ware family at Ditsworthy and Richard Lavers and then Robert Giles at Trowlesworthy. On both warrens, long nets were used to catch rabbits.

By this method, nets were arranged between burrows and feeding grounds, in order to catch the rabbits on their return from nocturnal feeding. The nets were 300ft long and 5ft wide, according to Crossing or 8ft wide, according to Haynes. (Le Messurier 1966, 61; Haynes MS) Hemery notes that they were made by warreners' wives and that 'Granny' Ware made the Ditsworthy nets herself. (1983, 219) The fibre used at Ditsworthy is not recorded. Poachers nets were frequently silk, as this is particularly light and ease of transport must have also been a requirement of the warrener. Flax makes a particularly strong thread and linen nets were manufactured commercially in the 20th century. (see Plate 4:15) Hemp is another possibility. (Ingram 1978, 6)

On netting nights, which could be three times a week in season, the nets were suspended on sticks, placed 10ft (3.05m) apart in the ground. (Haynes MS) These had been planted during the day or several days before netting night to familiarize the rabbits with them. (Le Messurier 1966, 62; Haynes MS) 15 or 20 nets could be joined together, and the required length must have depended on the particular location of netting. (Le Messurier 1966, 61) The sticks only stood 2½ft (0.76m) above the ground, leaving a considerable amount of loose netting at the bottom, described by the warreners as "a good bunt", with which to entangle the rabbits. (Haynes MS)

The nets were erected after dark, at about 11pm, when the rabbits were some distance away and they remained in position until dawn. At first light, one man and a team of dogs set off for the feeding grounds to round up the rabbits. Alarmed by the dogs, the rabbits retreated towards their burrows, only to encounter the nets, operated by the warrener and assistants. (Haynes MS) Crossing observed that the warrener twisted the rabbits' necks as they reached the nets, though some may have died, when entangled in the netting. (Le Messurier 1966, 61;

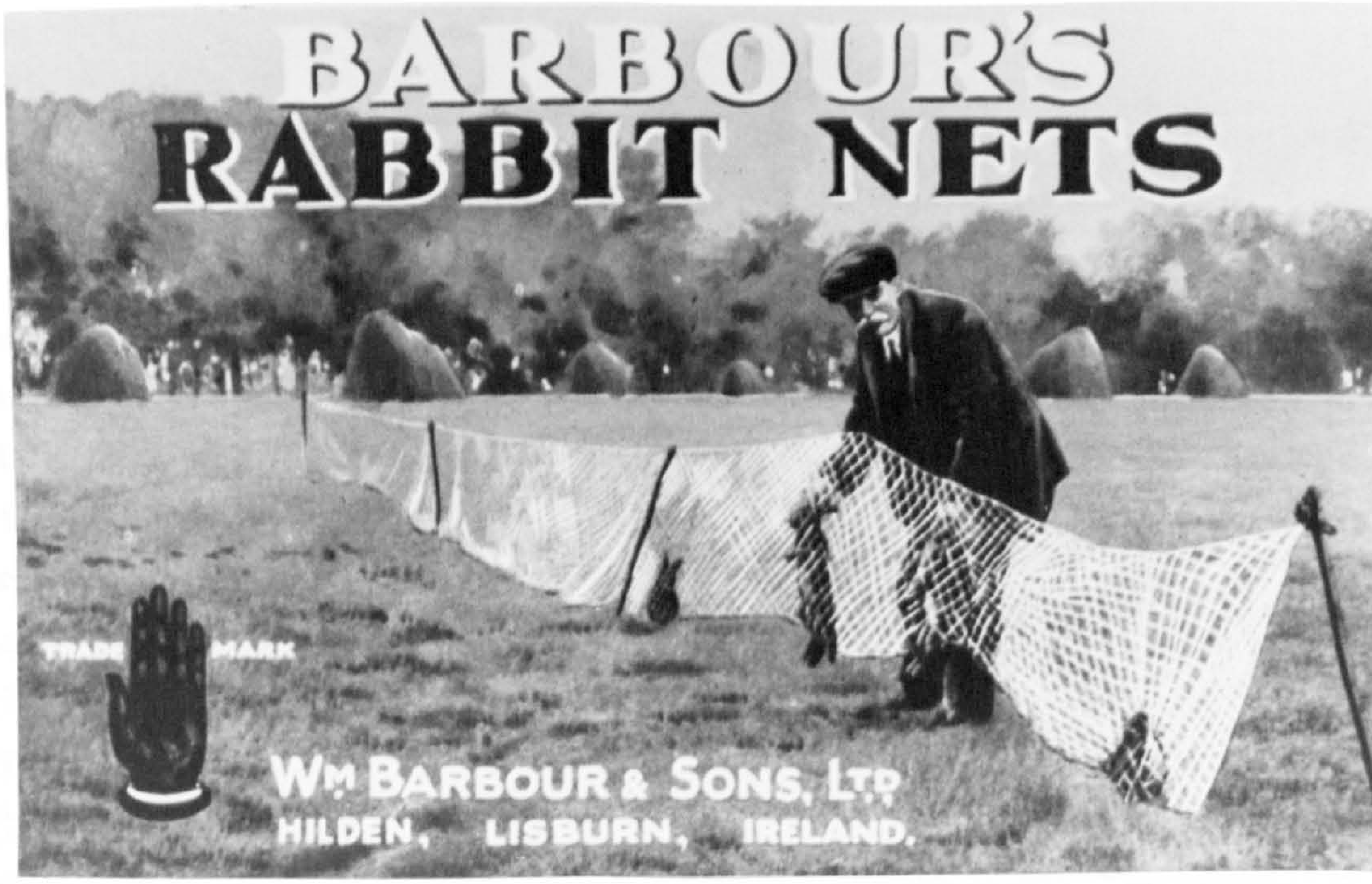


Plate 4:15 Advertisement for rabbit nets

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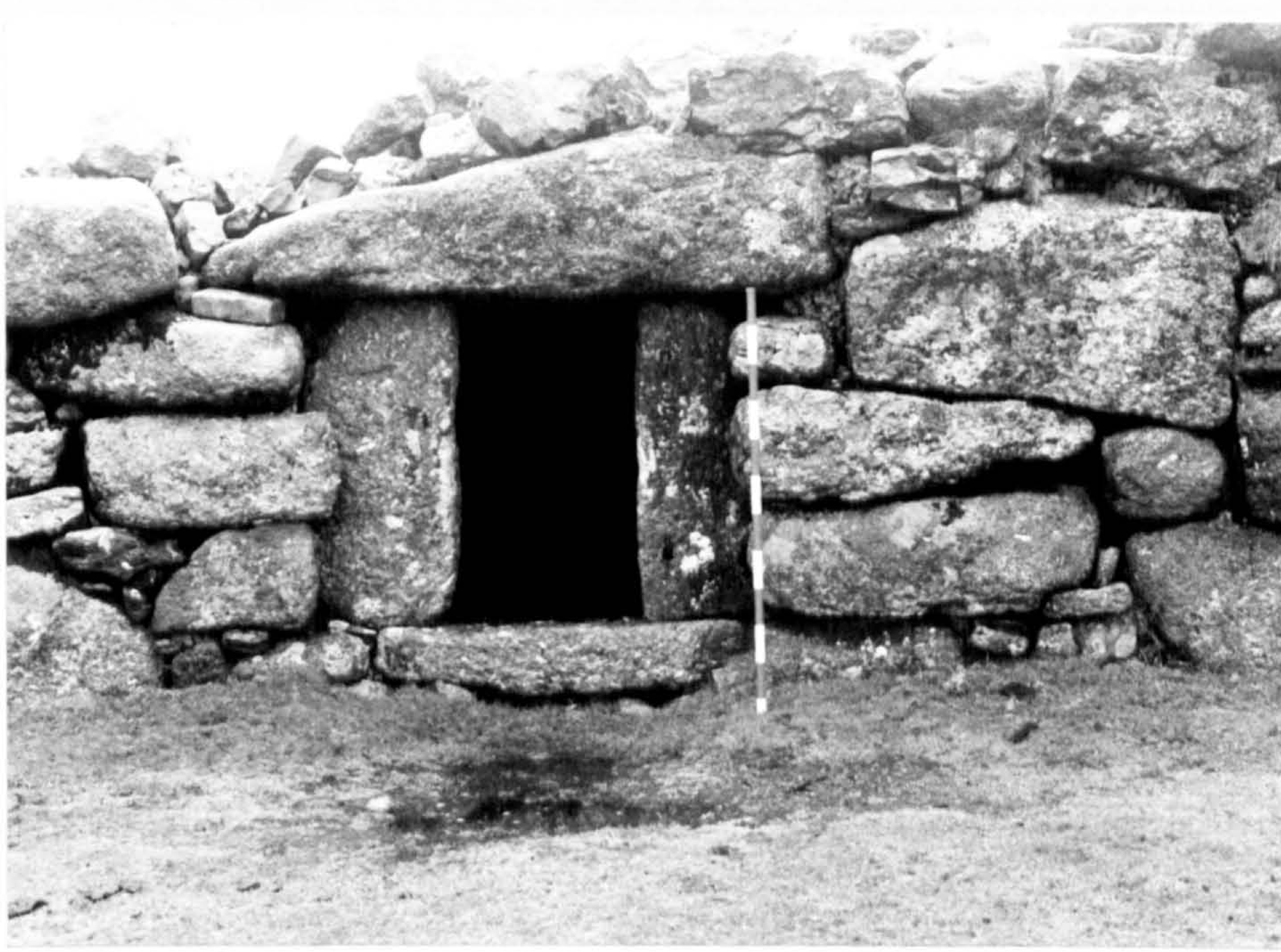


Plate 4:16 Dog kennel in kennel court, **Mon 880j**, at Ditsworthy Warren House

Simpson 1895, 109) Alternatively, the rabbits could have been clubbed with a stick. (Sheail 1971a, 64) Presumably as much speed as possible was required to avoid panic and attempts to return towards the dogs.

As noted above, discretion may have been exercised by the warrener at this point; young and female rabbits could have been lifted over the net to safety, though considerable skill would be required to distinguish between rabbits in the heat of the moment. Alternatively, the meshes in the net may have been sufficiently large to allow the smallest rabbits to escape. Crossing observed that a net 5ft (1.52m) wide consisted of 20 meshes, which indicates a mesh of 3 ins (0.07m) (Le Messurier 1966, 61) It was noted above (see p.268) that a mesh of 1 1/4 ins was recommended for a fence, with which to contain the smallest rabbits. Therefore, a 3-inch mesh may have been enough to allow the young to escape through the net, though they were more likely to become entangled in the loose netting.

Several men at the net would ensure greater speed of working and less panic. Haynes suggests that four or more manned the nets at Trowlesworthy and the most efficient operation probably required considerable manpower. (Haynes MS) Mrs. Ware employed eight or nine men at the peak of the catching season. (Hemery 1983, 219) Assistants were also employed at Trowlesworthy; Peter Gray, despite his age of 87, is described as a labourer at Trowlesworthy in the 1881 census, and presumably worked for Richard Lavers, the warrener. (PCL RG11) In the same census, no occupation is given for Richard's sons, aged 21, 23 and 27, and it might be concluded that they also helped on the warren. In all cases, further help may have been provided on netting nights by volunteers. (Haynes MS)

Dogs were also an important part of the operation. Crossing (Le Messurier 1966, 62) noted that a warrener used spaniels, but Haynes (MS) suggests that no special ability was required except "the desire to pursue a running rabbit and to bark". Nevertheless, warreners may have taken a pride in their dogs and the breeding of sporting dogs was an important sideline at Ditsworthy at the end of the 19th century. (*ibid.*) Special provisions were made for the care of the warren dogs. About 20 were kept at Trowlesworthy and a dog-pit in the kennel field, **Mon 130d**, was reserved for them. (Haynes MS) This was surrounded by a wall, 2.13m (7ft) high and 1.22m (4ft) thick at the bottom, tapering to 0.91m (3ft) thick at the top. Steps built up the outside allowed the warrener to throw food in without entering the yard. Barrels were provided for kennels. (Hemery 1983, 224, Plate 147) A similar arrangement existed at Ditsworthy, where the kennel court was enclosed by a 2m high wall, topped with corbelled coping. Three stone kennels were built into the wall, though Percy Ware provided drier accomodation in the form of thatched boxes. (Hemery 1983, 219-220; plates 140 and 146) (Plate 4:16) At Ditsworthy, ponds were dug (for example Mon 880p), for the purpose of storing carrion to be fed to the dogs. A high-walled yard with wooden kennels was also noted at Huntingdon warren , while a kennel survives at Headland warren, though the dog-proof wall of the court has collapsed. (Hemery 1983, 310,643)

It is possible that this method had been in use in UPV since the beginning of warrening. The earliest known lease for Ditsworthy Warren, dated 1676, permitted the tenant, Edward Meade, "to hunt by ferrett & pitch nette". (WDRO 70/189) The same methods of capture were noted in a 1762 lease for Ditsworthy and a 1807 lease for Hentor Warren. (DRO PZ11; WDRO 582/11/2) A "pitch nette" seems to have been one, which can be "pitched", that is, erected on sticks. (OED) It may then be concluded that the layout of the warren was planned according to netting procedure and that pillow mounds were built, on the one hand well-spaced to preserve pasture, as noted above (p.314), but also in groups to facilitate netting.

Several compact groups of pillow mounds are situated at intervals around the warrens. There are three groups of particularly closely-spaced mounds with interconnecting or common drains. Each group, **Mons 400a-d** at Trowlesworthy, **Mons 700a-e** at Ditsworthy and **Mons 811-814** at Hentor, may have been built as a single unit, possibly a netting unit. Long nets could easily enclose the whole group to catch rabbits returning from feeding. Other groups of pillow mounds are more dispersed but still well-defined. For example in Trowlesworthy, a net arranged parallel to the course of drain, **Mon 190**, might catch rabbits returning from feeding on the slopes above, to the group of pillow mounds, **Mons 192a-g**, close to the S bank of the River Plym. A net, placed along the NE side of some or all of the linear arrangement of pillow mounds, **Mons 394, 396-7, 536-9 and X6** in Willings Walls warren might be similarly effective; in this case the net could be continued to Spanish Lake to completely enclose the buries. A particularly long net might be required to operate the widely-spaced pillow mounds in E Legis Tor warren, **Mons 600-605 and 607-613**. However, these might have been divided into smaller groups, such as the line of four buries, **Mons 610-613**, along the W bank of the River Plym.

However, long nets may also have been used to catch rabbits already in the burrows. Crossing recorded this alternative method of enclosing a single mound and flushing out the rabbits with ferrets. (Le Messurier 1966, 61) Haynes noted the practice, in the modification of walls into pillow mounds, of dividing the wall into separate buries rather than one long, single mound, with the intention of facilitating netting. (Haynes Map TRO) Thus the wall, **Mon 831** in Hentor warren, may have been augmented and divided into five separate units for this purpose.

The use of ferrets to bolt rabbits into nets is documented from the earliest years of warrening. The ferret was known in domestication by Strabo (1st century BC) and documented in Britain by the 13th century. These early nets were probably "purse-nets", of a size sufficient to fit over a rabbit hole and usually pegged down. After blocking other detectable holes in the burrow system, or covering each one with a purse-net, a ferret was introduced to chase any rabbits into the nets. However, ferrets may have been used with "pitch nettes" in UPV, as permitted in the 17th - 19th century leases. In this case long nets could have enclosed any single mound or the most closely-spaced groups of mounds.

Ferrets were undoubtedly kept on UPV warrens; stone ferret-troughs were recorded at Ditsworthy and Trowlesworthy warrens. (Hemery 1983, 224) However, the use of ferrets does not seem to have been a common or desirable practice in the 20th century. Hurrell claims that ferrets were not used at Trowlesworthy, as the smell of ferrets lingered for a long time and discouraged the eventual return of rabbits. (1971b,152) The process could be laborious and the ferret could become confused in a complicated burrow system, though this was unlikely to arise in a pillow mound. (Sheail 1971a, 65) Greater danger was posed by an unmuzzled ferret, which was liable to kill a rabbit and remain underground. To counteract this, a narrow-headed spade was used to dig out the ferret, while the hooked spade handle could be used to drag out the rabbit. (Ingram 1978, 9) Any injury to the rabbit could reduce the value of the fur. Haynes remarked that ferrets were used in the UPV to bolt rabbits from "awkward" burrows, which were difficult to net otherwise, and, therefore this method may only have been used, in the 20th century at least, as a last resort. (Haynes MS)

In the absence of ferrets, other methods of dislodging rabbits have been recorded, such as the use of crabs and lobsters in coastal warrens, the playing of bagpipes and the introduction of smoke by burning, brimstone, old shoes, parchment or cloth at the mouth of the burrow. (Sheail 1971a, 66) However, there is no indication that any of these were attempted in the UPV.

Another method of catching rabbits, which seems to have been used at Wistman's Wood Warren, Dartmoor is the snare. A snare could be fashioned from sinews or entwined horsehair. (Bateman 1971, 170) However, by the 19th century most snares were made from twisted brass or picture wire. The method of manufacture is described in the following fictional account, based on the activities of James Rooke, warrener at Wistman's Wood Warren, Dartmoor:

> "He was perched beside a spreading bough, and therefrom, by bright threads, depended a zinc bucket. Within it lay a flat iron, and from time to time the man set pail and weight spinning freely. Then he loosed the utensil, examined those bright threads from which it hung and flung them into a shining pile at his elbow. Thus he continued to spin in metal, for each object contained 14 strands of copper wire and each, when finished, was a deadly little noose, bright as redgold, pliant as whip cord. (Phillpotts 1902, 7)

The snare is particularly effective in catching an animal of regular habits. The rabbit's hopping gait follows a regular pattern; it proceeds in long and short hops and on any particular run, always lands on the same places. It looks about after the long hops but never stops after the short hops. Therefore the skill of the catcher lies in recognizing the tracks and setting the snare just behind the short hop. (Ingram 1978, 6) The noose is set and held in place by a hazel twig, 0.09m (3½ ins) above the ground, to catch the rabbit round the neck. (Thompson and Worden 1956, 185) The snare can be attached either to a springy sapling, in which case the rabbit is thrown into the air on contact (Ingram 1978, 6), or to a stick driven into the ground, which restrains it until released, though in both cases, the impact probably often resulted in instant strangulation. (Harting 1898, 132)

The advantage of the snare is that one warrener working alone could catch the rabbits, but the work of catching each rabbit individually would be very slow. Furthermore, once caught and restrained the rabbit would be a target for predators, an outcome anticipated by the fictional warrener at Wistman's Wood:

> "Us'll see what Mr Fox have been at presently when we go round the runs. They'm near to humans for power of putting two an' two together. They know what my snares be for so well as you, an' they know I save 'em the trouble o' workin' for theerselves. So they just bide quiet, an' curl theer moustaches under the moon an' talk theer fox talk together till - 'squeal!' goes a catched rabbit. Then out they pops an' helps theerselves". (Phillpotts 1902,15)

A similar danger attended the use of steel-spring traps or gin-traps, in use by the 19th century, though the injury inflicted on the victim probably precluded their use on a warren.

Another method of capture seems to have been used on Headland Warren, Dartmoor. Here lush grass was cultivated within high-walled enclosures. The rabbits would be allowed in to graze through a creep-hole, which was netted when the rabbits were chased out. (Wilkinson 1986, 18) Yet another method, used, for example on Thetford Warren, Norfolk was the pitfall or tip-trap, in which a pit dug on a rabbit path was covered with a swivelling trap-door. However, the number which could be caught in one night may have led to suffocation in the pit, thereby tainting the meat, unless the pit was frequently checked and emptied. (Sheail 1971a, 66) This also probably provided a great temptation to the poacher.

4.4.4 Market.

The location of moorland warrens might pose considerable problems in the distribution of the catch. In 1274, the skins but not the meat of 2,000 rabbits were exported from Lundy Island, off the N Devon coast; this suggests that meat was not expected to survive the journey. (Sheail 1971a, 70) Salt must have been used occasionally to preserve the meat and was one of the items accounted for in the expenses of 14th century ferreters on islands off the Pembrokeshire coast. (Matheson 1941, 73)

However the UPV warrens were sufficiently close to large markets to allow the sale of meat and fur. The movement of rabbits around the warren, for example, from the nets to the warren house, was undertaken by donkeys. However, until the late 19th century, rabbits were generally sent to market by pack-horse. The load was fastened on a crook, a frame of willow poles, described by Mrs. Bray as "two *crooked* pieces of wood, turning outward like the inverted tusks of the walrus". (1838, 23) By this means up to 400lb, possibly 130 rabbits, could be carried by the strongest horses (Burnard 1905, 173), though Hemery recorded a usual load of about 300lb. (cited in Linehan 1966, 141)

Pack-horses were still in use when William Ware took over Ditsworthy in 1859. Sheepstor village could only be reached from the "in-country" by pack-horse until the middle of the century. Thus Baring-Gould, writing in 1912, knew of an old man from Sheepstor, who could remember the first cart coming into the village. (1912, 9) Pack-horses from Ditsworthy may have used the Eylesbarrow - Sheepstor road; although it was probably not improved until the Eylesbarrow Mine was in operation between 1814 and 1852, it follows an old wool-traders route, Jobbers' Path, **Mon 1085**. Formerly this track was reached by the "Church Path", passing over Gutter Tor, but this was replaced by the present access track, called "Sandy Path", which was made by the last warrener, Percy Ware. (Hemery 1983, 164) Percy Ware also improved the Eylesbarrow - Sheepstor road by building a bridge across Sheepstor Brook, with timbers from Buckland Abbey. (Hemery 1983, 169)

When the Rev. H. H. Breton was visiting Dartmoor, after 1907, the warreners transported their goods by cart along the "Ditsworthy Carriage Drive". (Breton 1911, 50) The horse and cart was probably introduced when this track was made in the later part of the 19th century by a manager of Roborough Estate. (Hemery 1983, 167) The track crossed Ringmoor Down from the present gateway through the corn ditch, **Mon 624b**, passed to the S of Ringmoor Cottage and continued across Lynch Common to Marchant's Ford and Meavy village. (*ibid.*) Little trace of this track survives on Ringmoor Down, but it is marked on early editions of OS 6" Maps. (1st Ed. 1887; 2nd Ed. 1906)

The Trowlesworthy warreners presumably also relied on pack-horses at first. The seven-stone clapper bridge, **Mon 256**, across Blacka Brook, recorded by Haynes was built by Richard Lavers, possibly to accomodate the horse and cart. (Haynes Map TRO 5)

The journey by horse and cart to Plymouth and Devonport was a 28-mile, six-hour return journey. (Hemery 1983, 219) However, problems in reaching the market must have been further eased by the arrival of the railway; in the later 19th century, the goods were carried by train from Yelverton Station. Plymouth and Devonport must have been important markets for warrens of S Dartmoor, though the railway may have enabled rabbits to be sent further afield. For example in the later 19th century, Jan Waye of Huntingdon sent his catch to London, while the Hannafords at Headland at one time supplied the Birmingham market. (Hemery 1983, 311, 645) Competition between the last warrens on Dartmoor seems to have been solved by an amicable agreement, arranged by Richard Lavers of Trowlesworthy at the end of the 19th century, whereby Trowlesworthy warren supplied Plymouth, Ditsworthy warren supplied Devonport, while Headland sent rabbits to Chagford market and the Huntingdon catch went to South Brent. (Hemery in Haynes MS) The large population employed in the local tin industry must also have provided a market for the Dartmoor warrens. In the early 19th century, the warren house at Headland was opened as the Birch Tor Inn to take advantage of the local mining population. (Hemery 1983, 643)

The principal uses of the rabbit are its meat and fur, though it seems that nothing was wasted. On the UPV warrens, rabbits were paunched at the house, before being sent to market, and the entrails were fed to the pigs and ferrets. (Haynes MS) Further, after the best of the fur was removed by the furrier, the waste was used for stuffing beds and bolsters, for manure or, by the 19th century, in the manufacture of gelatine. (Sheail 1971a, 77-8) In earlier centuries, skins may have been used in the manufacture of vellum.

a) Fur.

The fur industry was a major customer of the warreners. It is significant that the earliest known lease for Trowlesworthy as a warren was issued to a skinner. (WDRO 710/15) Uncommon furs were particularly valued. The majority of warren rabbits were greyish-brown in colour, known as the common-grey variety. Some warrens specialized in black or silver-grey varieties, though maintaining purity became increasingly difficult after the increase in the feral population, which was mostly common-grey. Also the distinction became less significant when the introduction of fur-dyeing allowed greater use of common-grey. Black rabbit fur was highly prized in the Medieval and Post-Medieval periods. Henry VII had night *boteux*, the legs of which were lined with black coneyskins and the feet with white lambskins. (Veale 1966, 15) Colonies of black rabbits were reared in the Breckland and in Kent in the 16th century, and there are still a few black rabbits on Lundy Island, off the N Devon coast. (Sheail 1971a, 25)

The fur of silver-grey rabbits was particularly valuable. In the 1850's, silver-greys from Thetford warren, Norfolk fetched 2s each in London. (Sheail 1971a, 26) Earlier, silver-greys played an important role in the export trade, particularly to the Far East in the 18th century, though this declined in the early 19th century and ceased after the Chinese Wars. (Sheail 1971a, 76) Silver-greys were concentrated in Lincs. and Yorks.; the colony at Askrigg, Yorks. was said to have been introduced by Sir Walter Raleigh. (Simpson 1895, 12)

There is no evidence that the UPV colonies were anything other than common-grey rabbit, but this retained an important place in the fur industry. It was noted above that rabbit fur may have lost prestige as soon as rabbits were locally available in the 13th and 14th centuries. (see p.246) However, while common-grey rabbit may not afterwards have been among the most valuable furs, greater availability introduced it to a wider market, while it is possible that the decline in foreign trade in the 15th century, followed by inflation in the 16th century may have increased the importance of all native furs, including rabbit. (Veale 1966, 161,172) In the 16th century, rabbit still featured in royal wardrobes, possibly to add variety; Mary Tudor's trousseau in 1514 included a gown of tawny velvet furred with coney, as well as gowns furred with sable and ermine. (Veale 1966, 10-11) However, common-grey fur also provided a means of emulating the privileged. Veale suggests that anyone who could afford it did his utmost to obtain at least one furred gown. (1966, 12) This would probably consist of cheaper fur and especially the abundant rabbit.

After the 16th century the fashion for fur lining waned; the restrictive styles then in vogue left little room for a fur lining, while wealth was displayed in the richness of the cloth such as velvet, damask and brocades rather than in the fur. (Veale 1966, 142,145) However, again this does not seem to have profoundly affected the demand for common-grey fur. Although, rabbit fur trimming regained popularity in the late 19th century, the bulk of it was used in the manufacture of felt for millinery. (Sheail 1971a, 75) Beaver was the preferred raw material, but its expense prompted the use of an alternative, which was increasingly hare and rabbit. The process involved the dampening of the pelt and stretching it flat so that the fur could be shaved with a sharp knife from the skin. (Sheail 1971a, 75) As with rabbit skins used for lining and trimming, fur for felt was in its best condition in the winter months, which conveniently coincided with the catching season. In winter, an ounce of wool could be obtained from each rabbit and the price varied, in 1800, from 20s per lb. of wool from the back of the animal to 12s per lb. for the tail wool. (Sheail 1971a, 75) In the 1860's, the fur-processing industry employed 8,000 people for four months of the year. (Sheail 1971a, 76)

The bulk of the UPV pelts probably served this market. John Nicholls, Junior, who took over Ditsworthy Warren in 1762 was described in the lease as a "felt-maker", while the mortgage, taken out by his father was payable to a felt-maker. (DRO PZ11) At Trowlesworthy warren, Richard Lavers, for a time, had his own "Hat Factory", **Mon 130c**, for the manufacture of square bowler hats. The top-price of his range was adorned with Trowlesworthy fur. (Hemery 1983, 222) Haynes (MS) suggests that Lavers may have been continuing an industry carried on in Plympton St. Maurice until the late 18th century. Crossing recorded that the skin-packing at Ditsworthy was once as important as the wool-packing of an in-country farmer, when up to £110 was received for skins in one year, though, writing in 1903, he also claimed that this remunerative sideline was finished as rabbits had now to be sold in their skins. (Le Messurier 1966, 63) However, Hemery (cited in Linehan 1966, 141) recorded that during the Second World War, warreners skinned their rabbits at the market and Haynes (MS) notes that skins were returned from the market to be dried and made into parcels of two dozen to be collected by London firms for manufacturing. Possibly at the time Crossing was writing, a measure had been introduced requiring the sale of rabbits in their skins, presumably to maintain and demonstrate freshness. On Haynes' and Hemery's evidence, this did not necessarily result in the loss of the pelt and its revenue.

b) Meat.

> Jan Roberts lives here
> Sells cider and beer
> Your hearts for to cheer
> And if you want meat
> To make up a treat
> Here be rabbits to eat.
> (advertisement for Birch Tor Inn (Headland Warren); quoted in Hemery 1983, 643)

The product of the rabbit, which reached the widest market was its meat. The earliest appearance of rabbit meat at royal feasts in the 13th and 14th centuries (see above p.243), demonstrates its early popularity among the privileged. This esteem seems to have continued into the 17th century, when it was declared:

> "there is none who deeme their house well seated who have nott to the same belonging a comon wealth of conies, neither can hee bee deemed a good house keeper that hath not plenty of these at all times to furnish his table". (Reyce 1618 cited in Barrett-Hamilton 1910-21, 188)

The rabbit would have been particularly valued as a source of fresh meat in the winter, in a period when much livestock was slaughtered in the autumn, in the absence of winter fodder. This may not have been so important after the agricultural improvements in the 18th century, but by this time the larger rabbit population and relatively lower prices made the rabbit available to an even wider group. As greater availability seems to have caused a drop in the status of rabbit fur, a corresponding decline may have occurred in the meat market. At the end of the 19th century, Shand commented that rabbit was largely ignored by modern *haute cuisine* because of its cheapness and abundance. (1898, 222) He suggests that this loss of prestige only began in the early 18th century, after the death of Queen Anne, as rabbit-tart had remained a favourite of that "noted gourmande and voracious eater". (*op.cit.*, 235) However, the very abundance of the rabbit may have contributed to its restoration to favour:

> "What is certain is that we shall always have him, not only in a sufficiency but in superabundance, and out of sheer charity to the farmers we are bound to consume him". (*op.cit.*, 224)

It is possible that more imaginative recipes for rabbit enhanced its reputation. Shand recommended, in particular onion sauce, but also mushroom sauce or curry to complement the rabbit. This contrasts with earlier culinary advice, which seems to have concentrated on roasting. This, Shand claims, is the worst thing to do with a relatively fat-free meat. (*op.cit.*, 235) The following directions were issued in "The Noble Boke of Cookry for a Prynce's Houseolde or any other estately houseolde", which may date to the late 15th century.

> "To rost rabettes [ie. young rabbits] tak and slay them draw them and rost them and let their heades be in first parboile them or ye rost them and serue them". (*op.cit.*, 236)

As well as the "rost", this writer also suggested a "cevy", in which pieces of meat were mixed in a broth with onions, grease and a "liour of brown bred and blod". (*ibid.*) However, there was probably little alternative to roasting when dealing with such large quantities as the 4,000 conies at the 1465 feast for George Nevill. (see above p.244) Further evidence of recovery of prestige may be seen in Mrs. Beeton's recommendation in the 1860's for a Game Dinner, in which Curried Rabbit accompanied Fillets of Hare *en Chevreuil*, *Perdrix aux Choux*, Fillet of Pheasant and Truffles, Lark Pudding, Salmi of Widgeon and Salmi of Woodcock. (1869, 993) However, the bulk of the market is probably represented by her ten recipes for rabbit, all costing between 1s and 1s 8d for four or five persons; these ranked in price with beef steak and kidney pudding and Irish Stew. (*op.cit.*, 494-500,288,345) The rabbit probably reached an even wider public through poaching, at no cost at all.

At the end of the 19th century, apart from the cost of cooked dishes, the rabbit compared well at the market with other meat. A rabbit fetched 9d (or *c.* 4½d per pound) in Tavistock Market in January 1897, compared with 5s 6d to 6s for a couple of fowls and 7½d to 8½d for a pound of beef. By the end of the 19th century the earnings of a farm labourer could reach £1 a week, when the average wage of 16s was supplemented by a rent-free cottage, free milk and other extras. (Hoskins 1959, 156) Taken as a proportion of a farm workers earnings, a rabbit at the turn of the century would be worth £3.75 today. Interestingly, this is not far above the present price; at Tavistock Market in May 1987 a rabbit cost £3.17 at the price of £1.20 per pound.

4.4.5 Income.

It might be concluded that the income on fur and meat added up to a lucrative business. It is difficult to assess the profits and standard of living of warreners. Any revenue would have to be set against expenses, such as rent, wages of hired labour, costs of extra fodder and of introducing new blood to the warren stock and of maintenance of walls, pillow mounds and ditches, costs of dogs, ferrets, horses and donkeys and of nets and traps and, finally, transport. Moreover, the seasonal nature of the earnings would also have to be considered and provision made for the summer months.

Some information on income can be gleaned from contemporary accounts. In the 1650's an agricultural commentator from Bawtry, Yorks. calculated a clear profit of at least £8 per acre *per annum* (cited in Sheail 1978, 347), though this is rather optimistic for marginal land. In 1810, a warrener's income was recorded of £750 from rabbits as well as £100 from other stock; after deductions of £276 for rent, £40 8s for wages and £15 for nets and traps, he was left with a profit of £518 12s. (Sheail 1971a, 84) In 1788, Marshall estimated that the sale of the meat would take care of the rent and expenses, leaving the skins as profit. (Marshall 1788, Vol 2, 233))

The increasing awareness during the 19th century that rabbits were not as profitable as once thought, will be discussed below (see section 4.5), but it remains to determine the success of the UPV warrens. Crossing's note of an income of £110 *per annum* earned at Ditsworthy from skins alone, may refer to the mid-19th century. (Le Messurier 1966,63) If, as Marshall suggests, skins represent profit, this indicates a respectable income, to be compared with, for example, the average wages of a farm labourer in 1840 of between £18 4s and £23 8s *per annum*, rising perhaps to £52 *per annum* at the end of the century. (Hoskins 1959, 156)

In 1881, the rent of the 33ha. (83 acres) Legis Tor warren was fixed at £140. (Hemery 1983, 218) Using the 1897 price of 9d per rabbit, 3733 carcases, or 155 per week over a six-month season would have to have been sold by the Wares of Ditsworthy to meet this rent alone. Some contemporary accounts attest the large size of catches; Jim Phillips, a labourer at Ditsworthy in the early 20th century recalled a catch on Hentor warren of 300 on one occasion and 480 on another. (*op.cit.*, 219) Although these catches were unusual, presumably several pack-horse loads would have been required each week. A single load of about 100 rabbits might, in 1897, have fetched £3 15s, and three per week over six months would earn £270, but even this may not have met the rent for the whole warren.

However, the success of the UPV warrens is clearly demonstrated by their longevity. While perhaps not accumulating great wealth, warrening may have been the most lucrative and competitive use for moorland. Furthermore, in the 19th and 20th centuries, a certain success may be indicated by the number of employees they were able to afford. (See above p.320) The status of warrening in the 19th century may also be indicated by the references to Ditsworthy and Trowlesworthy warrens in the series of <u>Kelly's Directories of Devonshire</u> from the mid-19th century. These provide a short list of the major farms and businesses in each parish. For example, in the 1857 directory, the inclusion of Nicholas Ware of Ditsworthy among the 15 principal inhabitants of Sheepstor parish, and John Mavers [Lavers] of Trowlesworthy among the 42 principal inhabitants of Shaugh Prior may indicate the important position of the warrener. The role of the Nicholls' as church wardens of Sheepstor may also suggest a certain standing in the community. (DRO PW1)

Lack of detailed documentation before the 19th century hinders assessment of the importance of warrens. Again the long history of the UPV warrens must indicate success. Some importance may be inferred from the incorporation of rabbits into the tinners' emblem. This symbol comprises three rabbits arranged in a triangle, with a single ear apiece joining in the centre. It appears on the carved roof-bosses in the moorland churches of Chagford, Ilsington, North Bovey, Tavistock and Widecombe-in-the-Moor. The extant buildings date to the 14th and 15th centuries and were built largely from tinners' funds. While the rabbit was an early fertility symbol, its adoption by the tinners may testify to its economic importance. (Plates 4:17 and 4:18)

4.5 DECLINE

By the 19th. century the warren industry was in decline. The damage caused by an over-abundance of rabbits was finally recognized. It has already been noted (see p.247), that the incorporation of rabbits with other livestock in an integrated farming system in the 18th century masked the effects of over-grazing. In the 18th and early 19th centuries, agricultural commentators extolled the virtues of the rabbit. Thus in 1788, Marshall attempted to vindicate the keeping of rabbits with the statistic that the fur of the rabbit was worth twice its meat in contrast to the wool of the sheep, which was worth only 1/6 to 1/10 of its meat.

> "Therefore, supposing the rabbit to consume a quantity of food in proportion to its carcase, it is, on the principle offered, a species of stock nearly three times as valuable as either cattle or sheep" (Marshall 1788, Vol 2, 233)

As late as 1895, Simpson was still advocating warrening on prime agricultural land in preference to other farming, particularly in a period of unfavourable cereal prices.

However, eventually the false premises behind such arguments were recognized. For example, Marshall had completely overlooked the comparative sizes of rabbits and sheep. (Sheail 1971a, 83) A 20th century study designed to calculate the scale of rabbit damage in New Zealand, found that 50lb of starch is required to feed one rabbit, while 500lb is required for one breeding ewe. (Thompson and Worden 1956, 26) Thus one sheep eats ten times as much as a rabbit. However, a comparison of the weights of the animals demonstrates that a 120lb sheep is 40 times heavier than a 3lb rabbit, and that consequently the production of a weight in rabbits equivalent to one sheep would require 2,000lb of starch.

Furthermore, the nutritional value of rabbit-meat was over-estimated. Thus recent studies have found rabbit-meat to have, weight

Plate 4:17 "Tinners' rabbits" roof-boss at the Church of St. John the Baptist North Bovey

Plate 4:18 "Tinners' rabbits" roof-boss at St. Michael's Church, Ilsington

for weight, under ½ the calorific value of beef and about 1/4 of mutton. Further the protein content is less than beef, though comparable with mutton, but, on account of the bulk of its viscera, only 41% of live weight of rabbit is edible, in contrast to 50% of sheep and 55% of ox. (Thompson and Worden 1956, 161)

While such calculations would not have been known to 19th century warreners, the effects of rabbit damage were nevertheless understood. Agricultural improvements of the 18th century, which to some extent benefited warrens (see above p. 247) may also have contributed to their demise. New breeds of sheep were introduced and shepherds became more aware of quality of pasture and consequently less tolerant of rabbit-grazing in integrated systems. (Sheail 1971a, 96) Gradually, it was recognized that land, previously shared by sheep and rabbits became more profitable if rabbits were excluded. (Wilson 1845-6, 443) In a comparison, in the 1950's, between rabbit-free and rabbit-grazed plots, the increase in weight in one year of sheep grazed on the latter was 20% less than sheep grazed on the former, while, in the second year, the discrepancy rose to 64%. (Thompson and Worden 1956, 169)

Furthermore, new techniques, such as irrigation allowed poorer land to be cultivated, in place of pastoralism, and earn greater profits. Thus in the early 18th century, the value of ground in Chaddesley parish, Worcs., formerly used as a warren, rose from 5s per acre to over 30s, when rabbits were evicted and irrigation introduced. (Sheail 1971a, 98) Such an early example may have encouraged other warreners to abandon rabbits in favour of more profitable pursuits. The rent for an estate of 2,500 acres at Blankney, on Lincoln Heath, formerly a barren sheep-walk and warren, rose about ninefold from 2s 6d an acre after enclosure in 1823, with weeding and manuring, enabled crops to be grown. (*op.cit*, 101)

The decline of commercial warrens on improved land may have benefited the remaining warrens on land, such as UPV, little suited to anything else and lack of competition may have contributed to the long-lasting success of the UPV warrens.

However, the remaining commercial warrens may have suffered in the 19th century from competition from the establishment of new sporting warrens and the more frequent inclusion of rabbits as game animals. Rabbits formed an increasingly large proportion of the game bag, such as the celebrated "Threes Bag", when, in a single day in 1861, 13 guns accounted for 3,333 rabbits, as well as 26 head of other game, at Bradgate Park, Leics. (Harting 1898, 115) Many landowners took advantage of the popularity of field sports as large rents could be obtained from shooting tenants. (Sheail 1971a, 113) The great number of rabbits killed on sporting warrens must have had some effect on commercial warrens; the spoils of a shoot may have competed in the market, though hand-killed rabbits commanded a higher price. (Simpson 1895, 32) However, Simpson, an advocate of the benefits of a sporting warren noted that at the end of the 19th century, there was no difficulty in disposing of rabbits to dealers, even at the height of the shooting season. (*op.cit.*, 33-4) Possibly, as competition for commercial warrens, the new sporting warrens may simply have taken the place of the abandoned commercial warrens.

However, the increase in field sports had important repercussions on the commercial warrens and the feral population. The number of wild rabbits in England had been steadily increasing; the agricultural improvements of the 18th century such as the sowing of winter crops, which had benefited some warreners, also helped the feral population. Animals, which in the wild would have starved over the winter, were now able to survive. The wild population further benefited in the 19th century when, in an endeavour to protect game, particularly pheasants and partridges though also rabbits and hares in game warrens, huge numbers of predators were destroyed. (Sheail 1971a, 110) For example, between 1874 and 1902, on one estate near Bettws-y-Coed, N Wales, 1988 kestrels were killed. (Matheson 1941, 378) The elimination of polecats and pine martens in Devon, largely by the 19th century, has already been noted. This destruction of predators must have protected the wild population as well as warren rabbits and winged game.

The problem of an increased feral population was exacerbated by the inability of the tenant farmer to control the pest himself. Under successive legislation of the 18th and 19th centuries, the right to kill game including rabbits was largely restricted to the property owner, though compensation for damage could be negotiated with the landowner. (Harting 1898, 175) However, the great damage to crops by the wild population was eventually recognized. This was summed up in a 1937 Report of a Select Committee of the House of Lords, which stated that:

> "the rabbit has seldom been killed which, on sale did not owe somebody several shillings as a result of its depradations"
> (quoted in Thompson and Worden 1956, 161)

Finally, under the 1880 Ground Game Act, tenant farmers were permitted to shoot rabbits to protect their crops. Though at first the law restricted the control to named persons (Worrall 1956, 202), this act must have initiated a profound change in the history of rabbits and warrens. Many of those, who might previously have bought at the market, could now take their own rabbits, though many probably did so previously illegally, and the warrener lost a significant proportion of his customers.

Warrens further suffered from foreign competition. Refrigerated ships brought rabbit meat from Australasia in the 20th century, but even in 1900, rabbits were arriving in tins. (Simpson 1895, 34) The fur trade also suffered; £341,735 worth of skins arrived from Australia in 1889, and £723,881 in 1903. (Sheail 1971b, 177) Competition also came from nearer home; in the mid-1850's, 50,000 rabbits a week were exported to England from Flanders and in the 1870's most meat sold in the Manchester markets came from Ireland. (Sheail 1971a, 80) Eventually, imports undercut the local produce and many warrens were abandoned.

Local conditions may have provided the final blow to some warrens. The competition from UPV warrens may have been the last straw, which put Huntingdon warren out of business after the First World War. (Hemery 1983, 311) In earlier centuries natural disasters could cause great loss or even abandonment of warrens. For example, storms in 1656 in Norfolk and in 1730 in Lincs., drowned many rabbits. (Sheail 1978, 346) A hard frost in 1739-40 in Norfolk also caused the deaths of many rabbits, putting considerable pressure on warreners. (Sheail 1971a, 95) Crossing blamed the blizzard of 1891, which killed thousands of rabbits on Dartmoor, for a scarcity of rabbits and consequent decline in warrening. (Le Messurier 1966,63) However, while the effects of this were probably still felt when he was writing in 1903, it is more likely to have been a temporary setback than the cause of warren decline. Such disasters may simply have weeded out some warrens, allowing the rest to continue.

In the UPV, myxomatosis and legislation finally brought an end to warrening. The death of Granny Ware in 1945, closely followed by the death of her son and successor in 1947, terminated warrening at Ditsworthy (Hemery 1983,219), but Robert Giles continued work at Trowlesworthy until the declaration of Devon as a rabbit clearance area on 2nd Feb. 1956. Unable, by law, to continue, he sold his nets to fruit-growers. (Haynes MS)

CHAPTER 5 : TIN-WORKING IN THE UPPER PLYM VALLEY

5.1 INTRODUCTION

Of all the different types of land use in UPV, tin-working has probably caused the most extensive modification of the landscape. Thus, the gravels in the bottom of the R Plym and all its tributaries have been turned over in search of alluvial deposits, the area between Drizzle Combe Head and Plym Head is covered with remains of surface and underground mining of lodes, and numerous pits have been dug, particularly on Ringmoor Down, in search of ore. A considerable number of extant structures, such as stamping mills, wheel-pits, shelters and houses are associated with tin-working, and numerous leats have been cut along both sides of the valley, to provide a water supply for tinworks within and beyond UPV. Furthermore, a significant proportion of the peat-cuttings may be attributable to the manufacture of peat-charcoal for smelting, which may also have been responsible for early clearance of woodland for wood-charcoal.

Tin-working may also cover a longer timespan than other forms of land use in UPV. Thus an industry, which continued until at least the 1850's may have its beginnings in the Bronze Age. In addition to the considerable archaeological remains, some documentary references for UPV tinworks exist, though until the 19th century, these rarely contain enough detail to assist interpretation of the field evidence.

The documentary and archaeological evidence will be examined in detail below and an attempt will be made to interpret the remains in the light of the documentary evidence and some of the numerous manuals, which have been published on mining methods and technology. However, first it may be useful to discuss the nature of the tin deposits, which may help to explain the different methods of extraction.

5.1.1 Geological Background

a) The formation of tin lodes.

Tin can be found in over 50 minerals, but most are very rare and unworkable and nearly all of the world's tin is recovered from the oxide ore, cassiterite, SnO_2. (Penhallurick 1986, 1) Cassiterite is usually very pure; for example ore from St. Mawgan in Pydar, Cornwall contains 78.7% tin. (Tylecote 1986, 44) Tin is one of the rarest metals; the average crustal concentration of tin is only two to three parts per million (ppm) compared to 55 to 70 ppm for copper and 50,000 ppm for iron. (Slater 1974, 3; Penhallurick 1986, 1) Most tin in the 20th century is produced in Malaysia, Indonesia, Bolivia, Thailand and China but Europe seems to have been the major source in antiquity, particularly in SW England, Brittany, Galicia in N Spain, Central France and the Erzegebirge of Central Germany.

The formation of metal ores in the SW peninsula seems to be related to the intrusion of granite about 290 million years ago. During the Devonian and Carboniferous periods, the whole of SW England, apart from a few isolated igneous intrusions was submerged. Fast-flowing rivers, which rose in the uplands to the North, deposited sediments, which were consolidated into sandstones, shales, conglomerates, slates, mudstones, cherts and limestones, collectively known in the South West as "killas". At the end of the Carboniferous period, in the Armorican orogeny, this very thick sedimentary deposit was folded on an approximately E-W axis and molten magma rose to fill the anticlines, forming a large batholith. The magma then solidified to form granite.

Weathering of the overlying killas gradually exposed five major granite cupolas on the mainland, Land's End, Carnmenellis, St. Austell, Bodmin Moor and Dartmoor, as well as minor bosses, though all seem to be connected at depth and belong to a single igneous mass, stretching from Dartmoor to the Scillies and probably 100 miles beyond. (Edmonds *et al* 1975, 44-45) The heat of the igneous intrusion altered the adjacent killas, creating a "metamorphic aureole" up to four miles wide around the granite bosses. (*op.cit.*, 49)

As the magma cooled and solidified, fissures opened up in the granite, the metamorphic aureole and contiguous rocks. (Dines 1956, 5) These were later filled by metallic ores, though the origin of the ores and the means of their deposition is a matter of debate. (Dines 1956, 7 ; Edmonds *et al*, 87 ; Hoskins 1964 *passim*).

In general, hypothermal ores including those of tin and copper, which crystallize at high temperatures (300°C -500°C) were deposited first, filling the ENE - WSW fissures, nearest the igneous mass. This zone was overlaid successively by the ores of lead, zinc and iron, which solidified at lower temperatures and filled the N - S fissures. The rise to higher levels of the cooler temperature ores seems also to have enabled them to travel further laterally and thus have a wider horizontal distribution. As Dines suggests (1956, 7), this may be because the fracture pattern, initiated in the granite became more open in the killas. Therefore, cassiterite as the deepest in the sequence, also covers the smallest area.

Metallic ores are accompanied by other minerals, the accessory and "gangue" groups, which were also deposited according to temperature and pressure. The accessory minerals are of secondary importance to the major metal ores, but have some economic value. Wolfram is the most commonly occurring example in the tin zone. Gangue minerals acted as a flux helping the metals to migrate upwards through the granite. Quartz is found throughout the ore sequence, while tourmaline and chlorite accompany cassiterite.

Erosion of the upper strata produced the eventual pattern of ore distribution, which, in plan, replicates the vertical zoning sequence. It may be an oversimplification to view the resulting distribution as an arrangement of concentric bands of metal ores. Nevertheless, in the Dartmoor area, the tin ores are mostly restricted to the granite boss while lower temperature ores occur in the metamorphic aureole.

Tin lodes vary in width; they are often 1m wide and sometimes much more. (Camm and Hosking 1984, 345) The Eylesbarrow lodes seemed promising to the 19th century adventurers. For example, the South Lode was found to be 1ft 8inches (0.51m) near the E end of Two Brother's Adit

(MJ 6.3.1847) but reached 3ft (0.92m) wide at the bottom of "Deep Adit" [ie. Deacon's Adit] W of Henry's Shaft (**Mon 1109**). (MJ 12.6.1847) The North Lode, when intersected in 1849, was found to be 1ft 8inches wide. (MJ 10.3.1849)

However, probably of greater importance was the richness of the lode, which also varied. (Edmonds *et al* 1975, 91) Edmonds, McKeown and Williams' observation (*ibid*) that amongst other circumstances, lodes "tend to be richest at .... intersections with other structures", is pertinent to the Eylesbarrow lodes, which were intersected by at least one caunter lode and several cross-courses. Caunter lodes are mineral lodes, which "diverge sharply in trend and dip from the general attitude of the lodes in any particular locality." (*op.cit.*, 88) Cross-courses are late fractures, approximately at right angles to lodes; they are usually barren and known as fluccans when clay-filled. (*ibid*) The "cross-lode", marked on contemporary plans intersecting the North, Middle and South lodes between Barrack Shaft (**Mon 1140**) and Old Ladderway Shaft (**Mon 1141**) is probably a caunter lode (WDRO WW21, WW20a) The line, also intersecting the lodes between [Old] Engine Shaft (**Mon 1148**) and Whitford's Shaft (**Mon 1152**), indicating that "Here they loads were Heav'd by a Flookin", probably marks the course of a fluccan or clay-filled cross-course, which has displaced the lodes. (WDRO WW21; Edmonds *et al* 1975, 88; Hosking 1964, 210)

Thus Capt. Spargo, in 1847, expected to find an "abundance of tin", between Pryce Deacon's and Old Engine Shafts because "it is seldom known where a cross-course comes in contact with the lode that it fails from making rich bunches of tin, and especially in such a strata, as decomposed granite, such as in this mine". (MJ 6.3.1847) Other cross-courses were noted E of Pryce Deacon's Shaft (MJ 3.7.1847) and several were observed on a passage through Two Brother's Adit. (MJ 5.6.1847) Edmonds, McKeown and Williams also suggest that rich lodes may occur at "changes of strike" (1975, 91) and therefore possibly at the change of strike of the three Eylesbarrow lodes marked on contemporary plans between Whitford's and Pryce Deacon's Shafts. (WDRO WW20a, WW21)

Furthermore, contemporary reporters believed that, as so much tin had been recovered at such shallow depths prior to 1847 (ie. £30,000-

worth of tin at only 10fms below adit level), deepening the mine would reap rich rewards. (MJ 6.3.1847)

However, Hosking (1964, 211) points out that, near granite centres, erosion had removed the upper portions of lodes and has probably obliterated many lodes altogether. If the Eylesbarrow lodes were so near the surface to allow such extensive surface working, it might be concluded that the area had been subjected to severe erosion. Therefore, it is possible that the lodes did not continue much further and that the final closure of Eylesbarrow Mine in 1852 was, as suspected by Cook, Greeves and Kilvington, because of exhaustion of the lodes. (1974, 175)

b) The formation of Alluvial Deposits.

Alluvial deposits are ultimately derived from the primary lode deposits. The "old men" and early writers on tin working in Devon and Cornwall understood this derivation but attributed the detachment and re-deposition of tin stone to the Biblical flood. (Carew 1811 ed., 26) The metaphor of "The Flood" is not entirely inappropriate, as the moorland streams were probably the principal agent of depositing the stanniferous gravels on valley floors, but the cassiterite was initially released from the primary deposits by weathering of the granite batholith, which may have begun in the Permian and continued through the Mesozoic and Tertiary. (Camm and Hosking 1984, 332, 350-1)

More recently, the periglacial conditions suffered by SW England in the Pleistocene may have caused severe erosion by alternate thawing and freezing. (*op.cit.*, 336) Meltwater in interglacials and interstadials swept eroded material downhill and into valleys. (*op cit.*, 323) Cassiterite pebbles were detached from gangue and parent rock during the thaw/freeze process and were deposited differentially by the sorting action of the river. Thus a dense mineral, such as cassiterite, which has a specific gravity of 5.4 (Tylecote 1986, 44), tends to be laid down in the upper reaches, collecting in pot-holes or deeper channels to form "placers", while lighter material, such as silica country rock, with a specific gravity of 2.5 (*ibid.*), continues in suspension. However, the finer particles of cassiterite could also be carried further downstream and some deposits may be under the present sea-bed, as sea-level at the beginning of this process may have been several hundred metres below present sea-level. (Penhallurick 1986, 156)

Placers may be classified according to their location. Thus alluvial placers occur on river beds (though these can be further sub-divided into fluvial, lacustrine, estuarine, littoral and submarine) while eluvial placers were deposited on hillslopes, nearer the parent lode and usually in "dry" valleys. (Camm and Hosking 1984, 325; Gerrard 1986, 26) Most of the extant cassiterite placers are products of the Devensian or last phase of glaciation, though earlier placers could have been deposited during earlier interglacials or within marine sediments on Pliocene platforms. (Penhallurick 1986, 156; Camm and Hosking 1984, 333-5) These would mostly have been destroyed by subsequent erosion and may often have been re-deposited by Pleistocene rivers, though some Pliocene placers may survive. (Camm and Hosking 1984, 337, 334)

The stability of cassiterite, which enables it to survive weathering is rare and thus metals such as copper and lead are not found in placers. (Shell 1979, 254; Greeves 1981, 149) However, gold can occur and must have been found by tinners in sufficient quantities to warrant the carrying of a quill specifically for the purpose of storing "little hopps of gold". (Carew 1811 ed., 23) This 16th/17th century Cornish practice was continued by 19th century Dartmoor streamers, (Bray 1838, 2, 375-6) and Walter Wellington, the Eylesbarrow smelter, sold gold from Sheepstor for about £40 in the 1820's. (Burt 1826, 185; Cook *et al* 1974, 166)

The nature of the placers was understood in the 18th century, and perhaps much earlier, even if their origin was not satisfactorily explained. Thus Pryce observed that the stanniferous strata or placers varied in thickness from 0.30m to 3.05m (1ft to 10ft) or more and in width from 1.83m (1 fathom) to the total width of the valley. (1778, 132) He noted that several successive strata might occur within one valley's accumulation, though the upper layers were usually of a poorer quality. (*ibid.*) (Penhallurick 1986, 155) The placers were found to consist of strata of sand gravel and pebbles, which contained particles or worn pebbles of cassiterite, ranging in size from a sand grain to a walnut. (Pryce 1778, 132)

However, it is important to note that the stanniferous strata were generally in the basal sections of the valleys, often resting directly on bedrock and frequently buried beneath a considerable depth of sediment or "overburden", deposited by subsequent river action. (Camm and Hosking 1984, 328; Penhallurick 1986, 155) The nature of the overburden depends on the environmental conditions prevailing during the period of deposition. Thus some stanniferous placers were overlain by periglacial granitic gravel, deposited after a relatively short interval, while others were covered by eroded soil from prehistoric and medieval farming. (Shell 1979, 254) In the Medieval and Post-Medieval periods, the deposits were covered by detritus or "tailings", often containing particles of tin, from tin works upstream. The depth of the overburden generally increases along the course of the river, from its head to the estuary, where sedimentary beds could reach 36.58m (120ft). (Edmonds *et al* 1975, 81) For example, in the lower reaches of two Cornish rivers, an overburden of 11.76m was recorded at Porth/Poth streamworks, Par, and one of 16m at Happy Union streamworks, Pentewan Valley. (Penhallurick 1986, 167 Fig. 72, 180 Fig. 83)

The overburden in the upper reaches could be much shallower; there are fewer tributaries to contribute sediments, while the steeper gradient of a hill stream allows a swifter flow, which can carry a greater load over a longer distance and therefore further downstream. Thus an eluvial deposit on St Austell Moor described by Borlase in 1758 was 5.49m (18ft) thick in total, with an overburden of only *c.* 3.3m thick. Nevertheless in more gently-flowing stretches of rivers running through upland basins, considerable accumulations could still develop. For example, an overburden of 7m to 8m covered the tin stratum in a moorland streamwork at Bolventor, Bodmin Moor. (Penhallurick 1986, 207 Fig. 114)

A distinction can probably be made within one river system, between the swiftly-flowing tributaries and the more gently-flowing stretches of the main river. Thus in UPV, Drizzle Combe, which falls 53m over a distance of 1350m (a gradient of 1m in 25.47m), and Langcombe Brook, which drops 83m over 1750m (a gradient of 1m in 21.08m) may have had a relatively shallow overburden. The more gently-flowing meandering section of the R. Plym between its confluences with Drizzle Combe and Legis Lake, in which it loses only 61m in height over a distance of

3100m (a gradient of 1m in 50.82m), may have had a thicker accumulation of sediments. This might be supported by a comparison of the heights of extant cliff edges, which mark the extent of the tin streamers work and roughly represent the depth of combined overburden and tin ground. It is further possible that this distinction is repeated in the nature of the tin deposits. Thus, only larger tin stones escaped transportation from the swiftly-flowing tributaries, while finer tin particles may have been deposited in a thicker stratum by the more gently-flowing stretch of the river.

It might also be appropriate to locate primary deposits, from which alluvial/eluvial deposits derived. Later opencast and shaft mining demonstrates a significant primary lode deposit on the North bank of the R Plym between Drizzle Combe and Plym Head. This could be accepted readily as the origin of tin placers in, for example, Drizzle Combe, Evil Combe and the R Plym itself. However, the origin of tin placers in Langcombe Brook and Deadman's Bottom is less obvious. There is little trace of the primary lodes in the moorland on the South bank of the Plym, apart from Plym Head, where a lodeback-work, **Mon 1203**, presumably followed a lode.

Thus a possible explanation is Beer and Scrivener's suggestion that many Dartmoor placers derived from vein swarms and stockworks, comprising thin veinlets of ore in and above the granite roof, which are now completely eroded. (1982, 128) As well as Langcombe Brook in the Plym Valley, other examples are found in the Walkham valley above Merrivale Bridge, on Dartmoor, in the extreme SW of Lands End and in the NE part of the Bodmin Moor granite. (*ibid.*; Camm and Hosking 1984, 340)

5.1.2 The Significance of the Archaeological Evidence

The archaeological remains of tin extraction can be divided on the basis of morphology and the nature of the tin deposit into three main categories:

1. the waste heaps and water channels of streamworks in the alluvial deposits.
2. the deep open gullies of surface lode work.
3. the shafts and adits of underground lode mining.

Sub-divisions of these categories and terminology are summarised in Table 5:1. Classification and interpretation of the remains have been helped considerably by previous studies, notably those of Dr T.A.P. Greeves and Dr G.A.M. Gerrard on the early tin industries of Devon and Cornwall respectively. (Greeves 1981; Gerrard 1986, summarized in Austin, Gerrard and Greeves 1989) Dr Gerrard's work became available only after the UPV survey and much of the analysis was completed. However, in order to achieve some consistency in interpretation and terminology of the remains of the tin industry, an attempt has been made to review the UPV evidence, according to Gerrard's classification. Meanwhile, accepting that it is necessary for the purposes of discussion to attempt some classification of UPV data, it must be questioned how well the archaeological remains reflect mining procedure or the development of the industry.

a) Chronological Sequence

The classification broadly follows a chronological sequence. It is generally accepted that alluvial tin deposits were worked before the primary lode deposits were tackled. (Lewis 1908, 3; Tylecote 1986, 43) Not only are these deposits easier to work, but the tin content of alluvial cassiterite is considerably higher than that of lode ore. (see below) A shift in emphasis in the tin industry from W Devon to E, and later, W Cornwall is documented from the early 13th century and is assumed to result from the depletion of major alluvial deposits in the E and corresponding rise of mining further West. (Hatcher 1973, 45-6; Gerrard 1986, 80-1) Progressive exhaustion of placers necessitated a transfer to lode-working from the mid-15th century. (Hatcher 1973, 46) Presumably the first efforts were concentrated on the most accessible lode deposits, that is the weathered surface or "back" of the lode but eventually these surface deposits were also diminished or individual deposits were worked to such a depth that underground mining became necessary.

However, it would be misleading to assume a straightforward progression from one type of extraction to another and considerable overlapping must have occurred. While lode-mining may have been introduced in the 13th century, streamworks probably remained the major source of tin until the end of the 16th century and may have been worked

Table 5:1 Terminology of Tin Extraction.

SOURCE OF TIN	ARCHAEOLOGICAL REMAINS	TERM
ALLUVIAL DEPOSITS		STREAMWORKS
	Shafts	HATCHWORKS*
	Parallel asymmetric ridges	CUESTAWORKS*
	Parallel ridges	PARALLEL WORKS*
	Parallel ridges with retaining wall	RETAINED DUMP WORKS*
	Irregular hummocks	RANDOM HEAPS
ELUVIAL DEPOSITS	Channels with few waste heaps.	TYPE A*
	Long ridges parallel to edge of work	TYPE B *
	Curved ridges angled to edge of work	TYPE C*
	Linear ridges angled to edge of work	TYPE D*
	Pits	SHOAD WORKS*
LODE DEPOSITS;		
SURFACE		OPENWORKS
	Deep gullies	BEAMWORKS
	Series of pits and heaps	LODEBACK-WORKS*
	Gullies	GULLIES
	Parallel gullies and ridges	PARALLEL GULLIES AND RIDGES
	Series of parallel narrow trenches	RIBBONWORKS
UNDERGROUND	Horizontal tunnel	ADIT
	Vertical or included tunnel	SHAFT
TAILINGS	? Heaps	FOSSICKING

* Denotes terminology from Gerrard (1986; summarized in Austin, Gerrard and Greeves 1989).

sporadically in succeeding centuries, such as at Wheal Providence, Sheepstor parish in 1815. (Cook *et al* 1974, 195) Therefore, the particular types of extraction were probably practised according to local circumstances and, between at least the 15th and 17th centuries, streamworks, openworks and shafts were all in use in different places in SW England.

Furthermore, the progression to lode-working may not simply be a result of exhaustion of the alluvial deposits. Thus, although the tin content of alluvial cassiterite is higher, the overall tin content of the "pay-dirt" is "usually much less than that of the poorest of the worked lodes". (Dines 1956, 19) Therefore, it is questionable that tinners always preferred to continue streaming, when lode deposits were recognized on the surface. Thus, Camm and Hosking accept that alluvial deposits were abandoned when the richest and most accessible parts were exhausted but suggest that "their popularity also diminished [as] marked advances in mining methods" allowed expansion of underground mines. (1984, 330)

b) Mining Methods

However, it would also appear that the classification does not necessarily reflect distinct types of mining. For example, it might be argued that no significant technological "revolution" led to the transition from working an alluvial deposit to a surface lode. Similar equipment seems to have been used in streamworks and early openworks. Carew, writing in 1602 when all three types of mining were in use, made no distinction between equipment used ; he refers simply to an iron pickaxe and a broad, iron-tipped shovel, though presumably the iron wedge was designed for lode work. (1811 ed., 35) In addition, both types of works depended on washing ore in a stream of water, after initial digging. Both used reservoirs and leats to store and convey water. Furthermore, the transition from openwork to shaft may have been a relatively natural progression undertaken when the lode was too deep to be excavated from the surface. Pits excavated in the floor of beamworks, such as in **Mons 1186** and **1192**, could be viewed as incipient shafts. Further, the method of stoping used in shafts and galleries, is surely the underground equivalent of shammelling in an openwork. (techniques are described below.) Carew's description of Elizabethan mining demonstrates the ease with which miners adapted to local circumstances.

> "Their manner of working in the load mines is to follow the load as it lieth, either sidelong or downright .... If the load lie right down they follow it sometimes to the depth of forty or fifty fathom .... From some of their bottoms you shall at noonday descry the stars. .... If the load lie slopewise, the tinners dig a convenient depth and then pass forward underground so far as the air will yield them breathing." (1811 ed., 35-37)

Thus, in an area, such as Crane Lake where all three types of remains are found in close proximity, there is no need to envisage three distinct types of mine or miner.

c) Influence of Technology

However, it should not be concluded that the history of tin mining in UPV followed a smooth course. Further investigation requires documentary references to supplement the archaeological evidence. The development of the tin industry seems to have had an episodic nature for a variety of reasons. Periods of expansion and prosperity were separated by intervals of declining fortunes and reduced output. To some extent this may be explained by technological improvements. For example, lode ore, less pure than alluvial tin, required more sophisticated preparation, so that the introduction of stamping mills possibly in the 15th century may have stimulated greater exploitation of lode ore. The application of gunpowder to mining in the late 17th century (Hamilton Jenkin 1962, 92) must have aided lode-working in areas of hard country rock. Conversely, expansion could be arrested by deficient technology; for example, in the late 16th century, the lack of adequate means to unwater deeper mines caused a depression in the industry. (Lewis 1908, 217)

Pryce (1778, 142) and particularly Borlase (1758, 168) implied that the step from openwork to shaft essentially depended on technological development. Thus Borlase described openworking as "a method too operose and expensive" and

> "it was not long before the tinners learned to make passages into the bowels of the earth, of dimensions no more than necessary to examine the lodes and bring off the ore." (*ibid.*)

However, while technical knowledge and ability was undoubtedly required to dig a shaft, emphasis on the contribution of technology to the industry may be misleading. The similarity in techniques used in streamworks and openworks has already been noted. Furthermore, the introduction of a new machine or technique did not necessarily immediately boost development of the industry. For example, adits are documented from the beginning of the 14th century in the royal argentiferous lead mines of W Devon. Thus, at "Byrlonde" production increased dramatically by 1303 when drainage by adit had replaced the old system of unwatering with leather buckets and allowed work to continue through the winter. (Hamilton Jenkin, 1962, 83-4) Yet, references to adits in tin mines do not appear until the 17th century. (Lewis 1908, 11; Greeves 1981, 155)

To some extent this may be explained by a gap in the documentary record and "it does not seem reasonable to doubt that [the adit] was in use much earlier." (Salzman 1923, 72) As Salzman points out, it is significant that the adits or "avidods" of the W Devon lead mines, referred to in 1297, were to be worked by one hundred tinners. (*op.cit.* 53, 72) However, it is still likely that general use of adits did not immediately follow their first appearance *c.* 1300. Similarly, water-powered pumps were used in the silver-lead mines some time before their widespread adoption in the tin industry. A small pump was documented at Beer Ferris in 1480-1 (Hamilton Jenkin 1962, 82), but pumps were not in general use until the 16th and 17th centuries. (Salzman 1923, 72)

d) <u>Economic Viability</u>

As Greeves points out, sophisticated equipment was more necessary in the 14th and 15th centuries in the lead industry, which lacked relatively easily worked deposits equivalent to the tin placers. (1981, 149) However, the distinction between the silver-lead mines of W Devon and tin mines also provides a clue to other factors contributing to the development of the tin industry. The royal coffers funding the silver-lead mines had more resources to finance costly equipment than the private capital invested in the tin industry, while the higher price of silver could cover greater expenditure. (Hatcher 1973, 46) This leads to the conclusion that any development in a tinwork depended not simply on the nature of the tin deposit or available technology but on economic viability, involving a fine balance of factors affecting expenditure and income. These factors are summarized in Table. 5:2. Alteration in one or

Table 5:2 Economic Viability of Development or Expansion of a Tinwork.

A) FACTORS AFFECTING SUPPLY/EXPENDITURE

Factor	Effect
WEATHER	Flooding could halt operations Water supply was necessary for stamping and blowing.
NATURE OF DEPOSIT	Accessibility of lode affects cost of processing Quality of ore affects cost of processing
TECHNOLOGY	Can enable less accessible deposits to be worked but at a price.
STRUCTURE OF INDUSTRY	
— CAPITAL SUPPLY	a)Capital required at all levels of tin production, by labourer and merchant tinner. Interest rates had direct effect on costs of production (Carew 1811 ed. 48-49; Hatcher 1973, 49-59, 148) b)From mid-14th Century, profit could only be realised at twice yearly coinages (Hatcher 1973, 49)
— LABOUR SUPPLY	Shortage of labour for 15 years after Black Death (Lewis 1908, 40; Hatcher 1973, 63) Miserable conditions of labourers and small independant tinners (documented by Beare in 1586 and an anonymous writer in 1697 (Hamilton Jenkin 1972, 50-51, 128) and by Hooker in the late 16th Century (ed. Blake 1915, 342)) encouraged desertion to alternative employment, notably agriculture. (Hatcher 1973, 63-4)
GOVERNMENT POLICY	
— PRIVILEGES	May have encouraged more people to participate. Eg. output increased after both John's charter of 1201, which granted right of free bounding and exemption from manorial service, and Edward I's charter of 1305 granting exemption from ordinary taxation (Lewis 1908,36-39).
— TAX	a)Output dropped after introduction in 1198 of a new tax of 1 mark per mwt. on second smelting (Lewis 1908, 134-5) b)After 1305 coinage duty fixed at 15s 7½d per 1200 lb. in Devon (40s per mwt in Cornwall) was a heavy burden on the tin industry (Lewis 1908, 149; Hatcher 1973, 48)

B)FACTORS AFFECTING DEMAND/INCOME.

Factor	Effect
FOREIGN COMPETITION	"The steady decline of the mining industry of SW England from about 1880 to the slump of the 1920's was due primarily to the exploitation of colonial ore deposits".(Edmonds *et al* 1975, 86)
TRADING CONDITIONS	a)General expansion of commerce aided the tin trade, eg. in late 14th, late 15th, and early 16th Centuries. b)The opening up of a direct sea route to important tin markets of the Eastern Mediterranean in early 14th Century enhanced tin trade. (Hatcher 1973 149, 95)
WORLD STOCKPILE	a)Durability of tin enabled supplies to accumulate and saturate the market, causing a drop in price. (Hatcher 1973, 149) b)A shortage of tin could cause a price rise eg. price doubled in 1350's after the Black Death (Hatcher 1973, 91)
INCREASE IN DEMAND	Eg. a 1509-10 report claimed that the King's purchase of tin for 100 pieces of artillery raised the tin price. (Hatcher 1973, 39)

more factors could upset the balance to such an extent that a particular tinwork was no longer economically viable.

In UPV, fluctuations in tin price in 19th century affected development of the Eylesbarrow Mine. Favourable prices in the early 19th century, probably caused by a combination of the Napoleonic Wars, the introduction of tinplate and the Industrial Revolution, reaching a peak in 1814 of £150 per ton probably prompted initial investment (Cook *et al* 1974, 164), and continuing high prices brought financial rewards in the early 1820's. (*op.cit.* 166) However, a slump in prices may have contributed to the decline in the early 1830's and again in the early 1840's (*ibid.*; MJ 6.3.1847), though as noted above exhaustion of the lodes may have caused the final closure in 1852.

Similarly, favourable conditions may have occasionally prompted a return to long-abandoned tinworks. For example, in 1797, Polwhele refers to Kerbeam, a beamwork West of Rattle Brook, a tributary of R. Tavy (SX 561845), as "an old pit, which had long lain dormant, but is now re-worked." (1797, 56) An old walled shaft, 15 fathoms deep, found in 1820 at Vitifer, was successfully deepened and worked by the Vitifer Company. (Hemery 1983, 614; Burnard 1891a, 94) Hemery suggests that the original shaft may have been part of mining operations documented in 1750. (1983, 614) Such re-working clearly demonstrates the pitfalls of accepting a straightforward chronological typology.

e) Local Factors: Management and Disputes

On individual mines, local factors may have influenced development. For example, while falling prices contributed to the failure of Eylesbarrow Mine in the 1830's and early 1840's, contemporary observers also blamed poor management and disputes with the landlord. (MJ 6.3.1847; 27.3.1847; 3.4.1847) Thus the management was censured by Capt. J. Spargo on the re-opening of the mine in 1847: "as to the last working, every practical and thinking miner in the neighbourhood must confess it was inaccurate as well as extravagant". (MJ 3.4.1847) In addition, a letter to the Mining Journal blamed the high wages (twice those of Birch Tor in 1820-21) and the "idleness and drinking" of the captains and workmen for lack of success. (MJ 27.3.1847) Good management was probably more significant in the complex underground operations of the 18th and 19th centuries, than in the earlier small-scale streamworks.

"A difficulty arising respecting the renewal of the lease" may have been the final unsurmountable obstacle, which stopped work at Eylesbarrow in January 1844. (MJ 6.3.1847) However, it was soon resolved and a lease was granted by the lord of the manor "at a rent of £5 *per annum* and at the reduced royalty of 1/20th", for 21 years from 25th December 1845. (*ibid.*)

Interference and restriction by landowners may have been more common in later mining, though disputes probably occurred from earliest times. The supremacy of the tinners over all others had been confirmed in Edward I's charter of 1305, which permitted tinners to:

> "Dig Tin and Turf for melting of Tin, everywhere in our Lands, Moors, and Wastes, and of all other Persons whatsoever in the county aforesaid". (Pearce 1725, 3)

However, by the 16th century, in response to increasing complaints about damages to land and harbours, the tinners "now fully recognized that there were other rights existing besides their own, (Crossing 1891-2, 182) For example, the Devon Tinners' Parliament of 1574 prohibited the digging for tin, without license from landowner and tenant, in meadows, orchards, gardens, mansion houses and cornfields. (Pearce 1725, 248) This may have occasionally impeded mining, but, conversely, may also have encouraged it, as landowners, capitalizing on their increased rights, sought to profit from mining revenues. (Broughton 1968, 38)

5.2 HISTORICAL BACKGROUND TO TIN-WORKING IN THE UPPER PLYM VALLEY

5.2.1 Documentary evidence for tin-working in the Upper Plym Valley

It is probably the financial rewards of tin mining, which have induced the wealth of literature on the subject. Greeves provides a useful summary of the history of the study of tin-working in Devon, from the publication of the statutes of the 16th century Tinners' Great Courts, to references in topographical accounts of Devon, to monographs devoted to the subject of mining, which appeared from the 17th century onwards. (1981, 19-21)

Contemporary accounts of methods of mining in SW England, such as Carew (1602 (1811 ed.)), Borlase (1758) and Pryce (1778) can aid interpretation of the field evidence and are therefore frequently discussed in the present study. However, the administration of the Stannaries in SW England is felt to be outside the scope of this survey; details of bounding, the arrangement of setts and leases, the organization of mining companies, and the provisions for taxation and coinage have little effect on the archaeological remains in UPV, and have already been discussed comprehensively by Pearce (1725), Pryce (1778), Lewis (1908), Radford (1930), Finberg (1949; 1950), Hatcher (1973), Pennington (1973) and Greeves (1981; 1987)

The documentary record of the Devon tin industry begins in the 12th century with the series of Pipe Rolls, which commenced 1155-6. (Hatcher 1973, 18) Almost as early is the first documentary evidence of tin working in Sheepstor and Brisworthy, or at least by residents of those places. In 1168 a justice of the forest fined Guy de Bretteville the sum of three marks "for his men of Sitelstorra [Sheepstor], because they have dug for tin in the king's forest against the rules." A fine of 20 shillings was imposed on the lord of Brisworthy for the same offence. (Finberg 1949, 157) The reference to rules suggests that some administration of the industry was already established by 1168.

At this time, West Devon surpassed Cornwall in tin production (Radford 1930, 228-9), though after the beginning of the 13th century, Cornwall gained supremacy. (Hatcher 1973, 19, 153-4) Greeves suggests that within Devon the growing importance of South Dartmoor may be indicated by the establishment in 1328 of Plympton as a fourth stannary town in addition to Chagford, Tavistock and Ashburton. (Greeves 1981, 27) Plympton stannary, which covered a roughly triangular area with apices at Plymouth, "Broken Borrow", now on the Tor Royal estate, (SX 618719) and Modbury or Burgh Island. (WDRO 72/991; Somers Cocks 1971, 76-79), covered all of UPV, though there are no direct references to tin-working on the Plym at this time. Booker suggests that the Plym Valley alluvial deposits were "the first to have been worked out, for the Tavistock stannary district which embraced it ceased to be the leading producer after 1381". (1970, 105) However, this ignores the establishment of Plympton as a stannary town in 1328. Stream-working must have continued as many of the documented UPV tinworks, which changed hands in the 16th and 17th centuries (see below) may be identified with streamworks. If the Plym Valley is involved, then it is more likely that its transfer to Plympton led to the decline of Tavistock stannary.

After initial success, the output of the Plympton stannary, calculated from coinage returns, seems to have been relatively small. For example, in 1385, Plympton was second in importance after Chagford, producing 28% of the Devon total, but in 1394 this dropped to 12% and thereafter Plympton generally lagged behind the other three stannaries. (Finberg 1949, 171) This continued into the 16th century, when Plympton again produced 12% in 1523 (*ibid.*) and only 6.7% at the Michaelmas coinage of 1595. (RN Worth 1876, 317)

However, South Dartmoor must have contributed to the gradual rise of tin production in the 15th century and the dramatic increase in the early 16th century. (Hatcher 1973, 157-9) Over a 20-year period from 1515 to 1534, the average annual output in Devon was 550,022 lbs. reaching a peak of 626,810 lbs. in 1521. (Hatcher 1973, 159)

It has been suggested that the building and enlargement of moorland churches in the 15th and 16th centuries owed much to the prosperity of the tin industry as well as the cloth trade. (Hoskins 1952, 246) For example, the early 16th century tower of the Parish Church of St. Pancras at Widecombe-in-the-Moor is reputed to have been built as a thank-offering by tinners. (Anon. 1984, 5) The connection with the tin industry is reinforced by the roof bosses carved in the shape of the tinners' symbol of three rabbits at the churches of Widecombe, North Bovey, Ilsington, Chagford and Tavistock. (See Plates 4:17 and 4:18) It is therefore possible that tinners' wealth also contributed to the rebuilding in the 15th century of Shaugh Prior Church, and in the early 16th century of Sheepstor Church. (Pegg 1986, 54-5)

The documentary record of individual UPV tinworks begins in the 16th century. The earliest references are to "Hyndtormeade" [Hentor mead] in 1527 and "Shabcomb/Shabercombe" [Shavercombe] in 1527 and 1532. (WDRO 72/990/15 and 17) Much of the information is found in a series of documents held in WDRO, which records acquisitions, mostly by the Strode family, in the 16th and 17th centuries. (WDRO 72/990; 72/1034) The known tinworks in UPV are listed in Appendix D and Fig.5:1 shows possible locations. A considerable debt is owed to Dr. T.A.P. Greeves' comprehensive list of Devon tinworks, dating between 1450 and 1750, compiled from documentary evidence. (1981, App.A)

Occasionally a detailed description of the boundaries is provided, allowing a connection to be made with extant archaeological remains. For example, "Foxter Marishe" tinwork, bounded at least by 1601, presumably relates to streamworks on the Trowlesworthy side of the R. Plym at its confluence with Spanish Lake and westwards to Legis Lake. (App. D; WDRO 72/1034) If one arrowshot is *c.* 100m, the tinwork could have extended up Spanish Lake to the point where it is now crossed by leat, **Mon 436**. "Hentorhill" and "Colemoor Rudge" are also easily identified, though there are no extant tinwork remains in either area. (*ibid.*) The only possibilities are the streamworks in Shavercombe and Langcombe Brooks, but these seem to be separate tinworks. "Shabercombe" is listed elsewhere as a tinwork (WDRO 72/990/15 and 17), and it might be reasonable to assume that "Langcombe" is also a tinwork in its own right. In another example, "Yeasterhill" is said to be bounded on the West side by "Yeasterbrook" [Spanish Lake], yet the headweir is a rock near "Trolsworthy Tor", which is West of Spanish Lake. (WDRO 72/1034) A possible solution is that "Yeasterbrook" refers to a streamwork, which is restricted to a part of Spanish Lake between "Foxter Marishe" and the tor, though there is no archaeological evidence of streaming above the leat, **Mon 436**. The only remains, which can be associated with "Yeasterhill" are streamworks on the R. Plym, NE of Spanish Lake. Other tinworks occupy Spanish Lake and Hentor Brook on the SW and NE sides. Possibly the boundaries were drawn as far uphill as "Trolsworthy Tor" to allow for any expansion into lodework. Presumably the bounds of "Hentorhill" and "Colemoor Rudge" were pitched primarily for lodework, though this does not appear to have been undertaken. The name of "Allhalloubeame" indicates that a beamwork was intended, but again there is no evidence of this, though it may be outside the UPV area as it was described as "streaming towards Yealm". (*ibid.*)

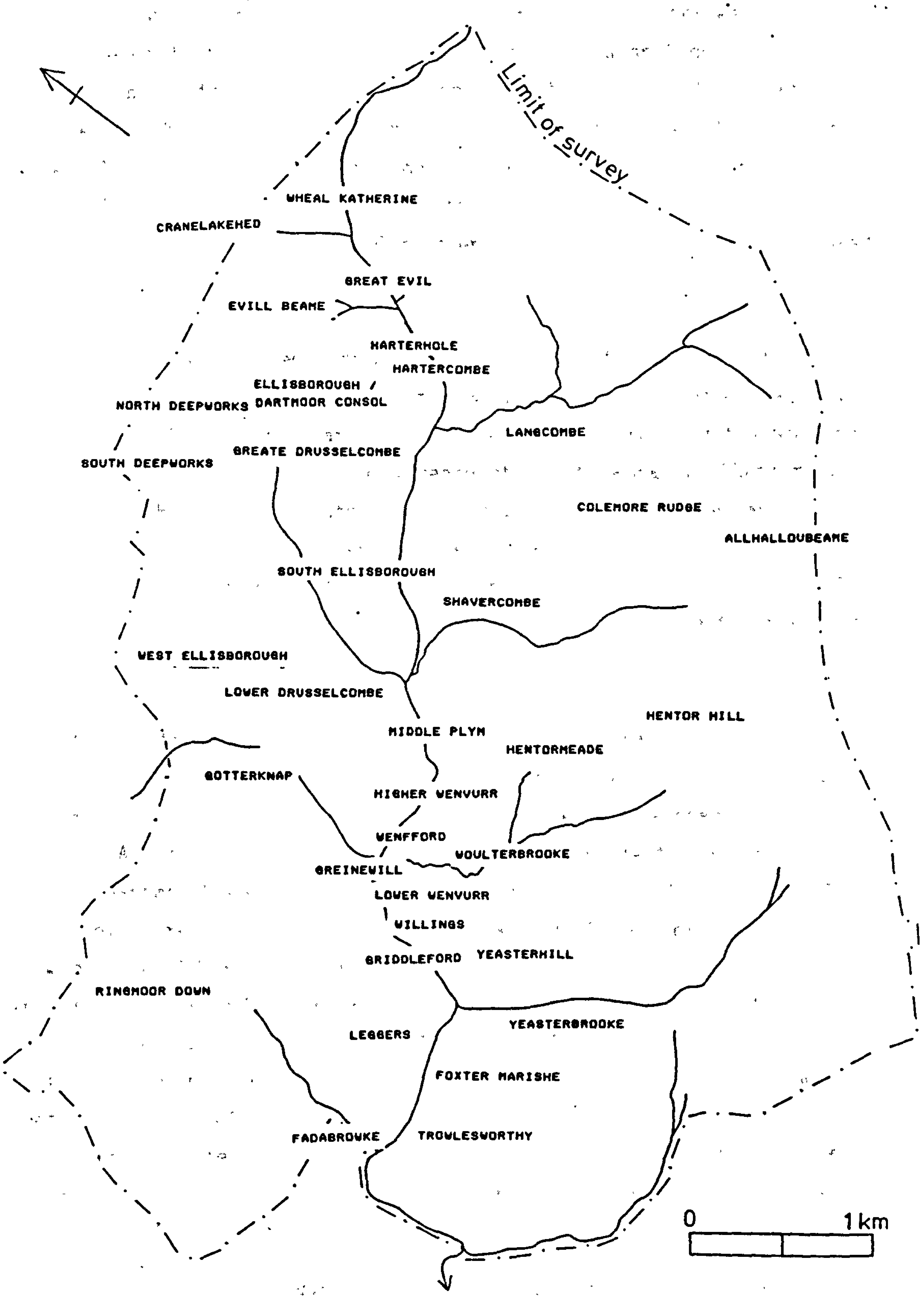


Fig. 5:1 The location of documented tinworks in UPV

Some tinworks are difficult to locate precisely. A series of tinworks seems to be situated around the foot of Hentor Brook. "Wenfford" and "Griddleford" mark the northern boundary of "Yeasterhill", while "Wenfford" shares the R. Plym with "Heigher and Lower Wenvurr" and "Greinewill". (WDRO 72/1034) Presumably these all relate to streamworks on the R. Plym, though it is difficult to identify relative positions. Greeves suggests approximate grid references and these have been followed in Fig.5:1. (1981, 347, 320)

These documents attest considerable tin activity in the 16th and 17th centuries, though it should be remembered that they concentrate on the interests of one family and are not necessarily the only tin-working in the area or the earliest. The absence of any tinworks at "Hentorhill" and "Colemoor Rudge" highlights the limitations of the documentary evidence: if these tinworks were not developed, there is no reason to suppose that the tinwork at "Wenfford", for example, was worked in 1625. The archaeological remains at the latter location could date to an earlier or later period.

A considerable industry is also suggested by references to the R. Plym in the frequent complaints in the 16th and 17th centuries of damage to estuaries and harbours caused by debris washed downstream from tinworks. An Act of Parliament of 1531 aimed to protect the harbours of Plymouth, Dartmouth and Fowey from silting up. (Burnard 1888/9, 98) In *c.* 1540 Leland reported that the Tory Brook, a tributary of the R. Plym rising outside UPV, ran red with sand from tinworks and that part of Plympton Priory, standing on the Tory, was "almost clene chokid" with tinners' waste. (Chope 1967, 56-7) In 1541-2, Plymouth Corporation arranged a survey at a cost of 3s 8d of the R Plym, which was the main threat to Sutton Pool, in Plymouth Harbour. (Hawkings 1987, 5) In 1638 the harbour of Cattewater in Plymouth was silting up partly because of the dumping of ballast and the failure to remove a "shipp sunck there eleaven yeares" and partly

> "by the great quantetyes of Sand and earth which divers Tynners working in a Tynneworke called Clasiewell and other works and Tynne Milles neare the Rivers of Plym and Mew [Meavy] ... convey out of their said workes and Milles into the said Rivers."
> (WDRO W9)

However, the Devon industry entered a slow decline in the mid-16th century; output fluctuated but reached only an annual average total of 184,448 lbs. in the 1560's, 149,004 lbs. in the 1590's, and 110,745 lbs. in the 1600's. (Lewis 1908, 254-5) Greeves suggests that participants may not have felt the impact until the mid-17th century, and presumably local variations depended on the performance of individual tinworks. (1987, 34) The documents recording the activity of the Strode family demonstrate a continuing interest in tin working in the early 17th century, though possibly tin-works changed hands more frequently in uncertain times. (WDRO 72/990, 72/990/84 and 91, 72/1034)

The effect of the Civil War on the tin industry is difficult to assess. Greeves concluded that it "dealt a near-devastating blow to an already ailing industry". (1987, 157) It certainly disrupted stannary organization; no tin was coined in Devon from 1643 to 1646. (Lewis 1908, 255) However, it might be suggested that moorland mines were sufficiently far from the main events to be seriously affected. Conveyances for shares in at least ten tinworks on SW Dartmoor in 1647 suggest that interest in tin-working continued. (Greeves 1981, 39) However, the low figure of 302lb for the whole of Devon in 1647 may suggest that, while stannary organization had been interrupted, output was also dramatically reduced and it seems that little of Devon was untouched by the events. Some prominent families seem to have been closely involved; for example, the Elfords of Longstone Manor, Sheepstor, some of whom were associated with UPV tinworks in the 16th and 17th centuries, were staunch royalists. (DRO DD1342; DD 4349; Hemery 1983, 161) Crossing recorded the belief that one of the Elfords took refuge in Pixies Cave near the summit of Sheepstor during the war. (1912, 451) On the other hand, the Strodes were parliamentarians and Strode was one of five MPs impeached during the Civil War. Furthermore, the occupation of the parliamentarian Drake's home at Buckland by the royalist Sir Richard Grenville meant that SW Dartmoor did not escape, as Sir Richard "scoured the countryside pressing men into service" and took money and food from the local people for his troops. (Gill 1968, 62) That a man from Sheepstor, who protested, was hanged suggests that the war came uncomfortably close to UPV. (*ibid.*)

Output from 1674 to 1683 averaged only 13,222 lbs. *per annum* (Lewis 1908, 255), but Greeves suggests that West Devon may have experienced a local resurgence in the 1660's. (Greeves 1981, 40) For example, in 1671, Eylesbarrow was recorded by Webster as one of the primary sources of tin in Dartmoor. On information received from Thomas Creber of Plympton St. Mary, he noted that "the hills where they get Tin Ore near that place where he lived, are called Yelsbarrow and Woolack." (Webster 1671, 290)

The Devon industry as a whole experienced a minor upturn in the early 18th century; output in 1706 reached 123,636 lbs. In 1715 all the parishioners of Sheepstor were said to be tinners as they contributed nothing towards the militia. (Cook *et al* 1974, 164) In 1719 there was a tin blowing house at Sheepstor and in 1730 one of only two blowing houses in Dartmoor existed at Sheepstor. (Greeves 1981, 41)

The general downward trend continued but UPV may have contributed to an upsurge in the 1780's. (Cook *et al* 1974, 164) In 1792 Crane Lake Mine, a streamwork had "only recently been opened". (*ibid.*) In 1808 tin from Sheepstor was taken to a smelter in St Austell. Cook, Greeves and Kilvington suggest that this came from the Ringmoor Down or Crown Hill mines, which, according to Lysons, were worked until 1809. (*ibid.*; Lysons 1822, cclxxxi) The Ringmoor Down mine presumably refers to workings on the northern slope of Ringmoor Down, associated with Kit Tin Mine (SX 563 675), though Hemery states that the latter operated until *c.* 1915. (Hemery 1983, 171)

A rise in price of tin may have prompted the revival in the early 19th century and tin-working on a large scale re-commenced in UPV in 1814 at Eylesbarrow. Until 1852, the mine was operated intermittently under various names, but "Eylesbarrow Mine" refers here to the whole period of working. Two contemporary plans are known: The "Plan of Ellisborough Tin Mine" (WDRO WW21) and "Plan of the Dartmoor Consolidated Mines". (WDRO WW20a) Cook, Greeves and Kilvington suggest that the first-named plan dates between 1823, in which year the last setts recorded on the plan were granted, and 1831, in which year Sir M. Lopes died. (Cook *et al* 1974, 175) Details of work in progress listed on both plans indicate that this plan is earlier. The title of the later plan suggests that it dates after 1836, when "Dartmoor Consolidated Tin

Mines" was formed. (MJ 4.6.1836) In addition to the plans, is a "Section of part of Dartmoor Consol. Tin Mines", which records additional shafts and adits and seems to reflect the situation at Eylesbarrow prior to the 1847 re-opening. (WDRO WW20b) These drawings will be referred to hereafter as the 1823-31 plan, the post-1836 plan and the pre-1847 section respectively.

The history of the mine has been documented in detail by Cook, Greeves and Kilvington (1974, 164-177), but it may be appropriate here to summarize the different episodes of the mine and their associated monuments. Archaeological remains will be discussed below. The Ellisborough Tin Sett was granted in 1814, and work began in 1815. (WDRO WW21; Cook *et al* 1974, 164) The contemporary Plan of Ellisborough Tin Mine illustrates shafts and surface constructions, which can be equated with archaeological remains. Work seems to have been concentrated in two separate areas. To the West of the sett, a group of shafts (Jenkins, **Mon 1108**, Deep Adit Shaft, **Mon 1111**, and "Shaft at the mouth of Deep Adit" were worked, possibly all associated with Deep Adit. Further E is a group of shafts (Hawk, **Mon 1132**, Barrack, **Mon 1140**, Old Ladderway, **Mon 1141**, Philp, **Mon X24**, New Footway, **Mon 1150**, [Old] Engine, **Mon 1148**, Whitford, **Mon 1152**, and Pryce Deacon's, **Mon 1154**, associated with Shallow Adit, **Mon 1099** and/or pumped by the engine wheel, **Mon 1097** and its flat-rod system, **Mon 1103**. Buildings erected at this stage, many of which remained in use, though occasionally modified, throughout the life of the mine, include the Account House, **Mon 1134**, the Barrack House, **Mon 1135**, the Sample House, **Mon 1136**, two Powder Houses, **Mons 1137** and **1128**, the Turf House, **Mon 1129**, the Timber House, **Mon 1130**, the Blacksmith's Shop, **Mon 1143**, and two "cot houses", **Mons 1098b** and **1069**. To this episode also belongs the series of dressing floors, **Mons 1094, 1093, 1091, 1070, 1066b** and **1064**, which may typify the extravagance blamed by later adventurers for early failures. (MJ 3.4.1847) In 1822, "Ailsborough", Vitifer and Whiteworks were said to be the three major mines on Dartmoor. (Lysons 1822, cclxxxi) The importance of "Ailsborough", or at least the optimism of the first proprietors is indicated by the building of a smelting house, **Mon 1066b**, c and d, though it seems to have operated only between 1822 and 1831. (Cook *et al* 1974, 166)

Fortunes declined at the beginning of the 1830's but a price rise may have initiated a fresh impetus in 1836, when 7500 shares of £5 each were offered in Dartmoor Consolidated Tin Mines. (Cook *et al* 1974, 167; MJ 4.6.1836) However, optimism was short-lived and an advertisement for the sale of the mines and equipment appeared in September 1844. (MJ 28.9.1844) The Plan of the Dartmoor Consolidated Mines records some of the work acheived during this period; early shafts were deepened and drifts extended. (WDRO VW20a) Descriptions of the mine prior to the 1847 re-opening and a "Section of part of Dartmoor Consol Tin Mines" indicate that new shafts had been sunk (Sutton, **Mon 1116**, Henry's, **Mon 1109**, New, **Mon 1107**, Whimb, **Mon 1104**, and possibly Midsummer, **Mon X25**, and Michaelmas, **Mon X26**) and two adits had been constructed (Two Brothers' Adit, **Mon 1112**, and Deacon's Adit) (MJ 6.3.1847; 10.7.1847; WDRO VW20b) The "New Engine Shaft" marked on the Section may be the re-use of Barrack Shaft, **Mon 1140**, or Philp Shaft, **Mon X24**.

A further effort began in 1847 with an offer of 2048 shares of £2 in a major new investment, which planned to clear the adits dug in the previous venture and extend existing shafts. (MJ 6.3.1847) A new shaft, Henry's Engine Shaft, **Mon 1153**, was sunk and a 50ft water wheel, **Mon 1111**, and new flat-rod system, **Mon 1114a**, were erected for pumping. (MJ 26.6.1847; 3.7.1847) By 1849 reports to the Mining Journal were under the heading of "Aylsborough", but after a period of silence, and possibly inactivity, in 1850 shares in Wheal Ruth were offered in 1851. (MJ 19.4.1851) This final episode saw the sinking of another new shaft, **Mon 1166**, pumped by flat-rods, **Mons 1114a** and **b**, at a great distance from the wheel. However, even this small success was short-lived and. in September 1852, the mine and equipment were advertised for sale. (MJ 25.9.1852) (See Fig. 5:2)

Setts for West Ellisborough (Leedon Hill), South Ellisborough (East bank of Drizzle Combe) and Ringmoor Down were granted in 1823, though there is no evidence of tin working associated with these licences. (WDRO VW20a) As noted above, pits on the northern slope of Ringmoor Down were probably associated with Kit Tin Mine situated to the N of UPV. The sett for Wheal Katherine was granted in 1817; the engine wheel house, **Mon 1200**, shafts **1199** and **1201**, and a dressing floor, **Mon 1198** presumably date to this period. A licence was granted in 1851 and renewed in 1852

VALUABLE MINING MATERIALS FOR SALE.—AILESBOROUGH MINE, SHEEPSTOR, DEVON.—TO BE SOLD, BY PUBLIC AUCTION, by Mr. WILLIAM MONK, on THURSDAY, the 30th day of September inst., at Ten o'clock in the morning, at AILESBOROUGH MINE, aforesaid, the following valuable MATERIALS, of and belonging to the said Mine, viz.:—an excellent WATER-WHEEL (built in 1843, and now in very good condition) 50 feet diameter, 3 ft. breast, with cranks, sadles, brasses, &c., complete, three balance bobs, with arch heads and pin chain complete; 10 fm. liftt of 8 in. pumps; working barrels; door-pieces, windbores, castings, prongs; bucket rods, &c., to match; pair of shears and sheaves; new whim; poppet heads and pullies; 30 fms. whim rope; single purchase wince, with 10 fms. tackle rope; capstan rope; 143 fms. iron rods, 2¼ inches wide by 2⅜ inch thick, with joints, pins, &c., complete; 153 fms. iron rods, 1¾ square, with joints, pins, &c., complete; 342 fms. of round iron rods, from 1¼ in. to 1⅝ in., with pins, joints, &c.; 139 cast iron pullies of 17-inch diameter, nearly new; 40 ditto, of 20-inch diameter; 4 whim pullies; 1 V bob with axle, iron stays, sweeps and rools to match; NEW STAMPS' WHEEL, 17 ft. diameter, 2 ft. breast, with 6 heads of stamps; 20 fms. of launders and stays; 3 oak kieves, buddles, sieves, &c., complete; 1 36-inch smiths' bellows; smiths' anvil and vice; excellent pair of screw stocks, lifting jack, screwing plates, taps, &c.; 2 cranes, in smiths' shop; quantity of smiths' tools, smiths' tool chests, miners' tools and chests, quantity of new and old iron, large carpenters' bench, 1 small ditto, grindstone and frame, 1 whip-saw, hand-saw and other tools, cask of gas tar, 70 fms. ladders, nearly new; several wheel and hand-barrows, 3 12-inch pumps, 6 feet long; 1 12-inch working barrel, &c., &c.

The whole of the before-mentioned plant and materials may be viewed on application to Captain Gregory, at the mine; and further particulars may be obtained on application to the auctioneer; or Mr. Robins, solicitor, Tavistock.

Tavistock, 21st Sept., 1852.

Fig. 5:2 Advertisement for the sale of mining materials at Ailesborough Mine, 21st September 1852 (from Mining Journal 25.9.1852) to JH Deacon, who sold £120 worth of tin at the end of that year, though the licence was surrendered in 1856. (Cook *et al* 1974, 177) Another licence was granted in August 1856 to Bartholomew and John Robins of Bere Alston and shares were offered in Oct. 1856, but little or no work was done at this time. (*ibid*)

This seems to mark the end of tin working in UPV. Cook, Greeves and Kilvington suggest that exhaustion of the Eylesbarrow lodes may have been the cause, as the tin price in the 1850's was favourable. (*op.cit.*, 175) Tin mining continued into the 20th century elsewhere on Dartmoor. Hexworthy was worked until 1919, while Birch Tor/Vitifer and Golden Dagger continued into the 1930's, though in the last two, the final operations were restricted mainly to fossicking. (Greeves 1986, 6, 24, 46)

5.2.2 <u>Miners of the Upper Plym Valley.</u>

It may be valuable to consider the people involved in UPV tin-working. It is difficult to calculate the total number of people engaged in the tin industry, particularly before the 19th century. The number of labourers is indicated, though only for the late 13th century, by a tax or "black rent" of 2d per head on all diggers of tin. For example, this accounted for 149 working tinners in Devon in 1243, 300 in 1288 and 457 in 1292. (Finberg 1949, 270) Another source of information is the Lay Subsidy Roll, which in 1373/4 recorded over 1000 tinners on Dartmoor, including 209 in the Plympton Stannary. (Lewis 1908, 44)

Coinage rolls list the names of people who presented tin for coinage but much tin may have changed hands before coinage. Thus, 440 working tinners paid black rent in 1301, but only 134 names appear on the coinage roll in 1303. (Finberg 1949, 172; Hatcher,1973,76) Hatcher envisages a three-tier system, in which London-based dealers ran the international trade and sponsored "tin merchants" or entrepreneurs from the South-West, who in turn financed local operations, by either loaning funds to labouring tinners or by managing individual tinworks with hired labour. (1973, 51) Of the lowest tier, hired labour would not appear on the coinage rolls and rarely independent tinners. Loans secured to finance their operations were often repaid in black tin before coinage (*op.cit.*, 67-8) Some major tin producers emerge from coinage evidence;

for example Elis Elford presented 8061 lbs for coinage at Tavistock in 1523. (Finberg 1949, 172) However, Finberg argues that such capitalists were less common in Devon than in Cornwall; the Devon tin industry always had a place for the "small man". For example during the early 16th century boom, only 104 entries out of 1177 in the 1523 coinages accounted for over 1 mwt. (1200lbs.) Small-scale production particularly predominated in Plympton stannary, where only four entries exceeded 1 mwt. in 1523. (*ibid.*)

Many of the names in UPV documents seem to belong to the entrepreneurial class. In the 16th and 17th centuries, members of the Strode family predominate in the surviving evidence. This prosperous family from Newnham, Plympton St. Mary were hardly working tinners and are usually described in the documents as "knight" or "gent." (WDRO 72/990/31; 72/990/91; 72/990) Some were heavily involved in the tin industry; Sir Richard Strode, who had shares in six UPV tinworks in 1639 (WDRO 72/990), acquired 1/3 share of "Cranelakehed" along with 26 other tinworks in 1640 (WDRO 72/990) and acquired shares of North and South Deepworks in 1641 (WDRO 72/990/91), had shares in at least 85 tinworks in SW Devon between 1625 and 1655. (Greeves 1981, 38)

An ancestor, another Richard Strode, MP for Plympton gained notoreity by his imprisonment in 1512 in Lydford Castle for attempting to curtail tinners' privileges at Westminster, though he was himself active in the tin industry. (Radford 1930, 236-7, 244-7) Thought to be a young man in 1512 and without an heir until 1539 (*op.cit.*, 234), he may be the younger of two Richard Strodes involved in a 1527 transaction; Francis and Richard Strode esquires, sons of Richard Strode, received by letter of attorney, possession of "Hyndetormeade", "Shabcomb" and 17 other tinworks. (WDRO 72/990/15) It is possibly the same Richard Strode, who conveyed 50 tinworks, including "Leggers" to John Strode in 1538. (WDRO 72/990/21) A relation, Philip Strode, Gent. of Plympton and later of Shaugh, gained possession by letter of attorney of 1/12 part of "Harter Hole" in 1585 and 1/8 part of both "Great Willings" and "Middle Plym" along with shares of three other tinworks in 1599. (WDRO 72/990/60; 72/990/31) William Strode acquired 1/6 part of "Harterhole" in 1625. (WDRO 72/990/84) Curiously, considering the scale of the family's operations, the name of Strode does not appear on the 1523 coinage roll.

(Finberg 1949, 175, 179-80) However a Richard Strode is listed as a stannator or jurate for the Plympton stannary at the Great Courts of Devon Tinners in 1687/8 and 1703. (Greeves 1987, 158-9)

Another notable name associated with tinworking in UPV is that of Woollcombe; in this case the UPV interest is two-fold for from 1560, Woollcombes owned Trowlesworthy Warren amongst other properties. (WDRO 710/11-710/23) In 1625 John Woollcombe gave possession of 1/6 part of "Harterhole" to William Strode. The same two men may be those named in a transaction concerning Trowlesworthy 35 years earlier: in 1585, John Woollcombe of Holland, Plympton St. Mary, yeoman acquired Trowlesworthy (WDRO 710/13), and in 1589/90 he leased it to William Strode of Newnham, esquire. (WDRO 710/14) (see above p.191) In the latter document he is described as "John Wolcombe alias Bowden of Holland, gent." His connection with tin mining is supported by the listing of "John Baldwin als Wolcomb gt." as a jurate of Plympton stannary in the 1600 Devon Great Court. (Finberg 1950, 297) He might also be identified with John Bowden of Brisworthy, who conveyed 1/4 part of "Wenfford" tinwork to a member of the Strode family prior to 1625. (WDRO 72/1034) Another John Woollcombe of Shyttistor [Sheepstor], who may be the builder of Yeo Farm (1610), had obviously played a major part in the tin industry in the mid-17th century. (Worth 1940, 223) He was the former owner of shares in 35 tinworks acquired by Sir Richard Strode in 1639. (WDRO 72/990) A later John Woollcombe was a Plympton stannator in the 1703 Great Court. (Greeves 1987, 159)

The Elfords, who from the 15th to 18th centuries were seated at Longstone Manor and were a leading family in Sheepstor parish participated in the tin industry. (Hemery 1983, 115) Elis Elford, the early 16th century entrepreneur, may have been part of this family. "Walter Elford, gent.", who in 1599 acquired ½ share in a tinwork called Lyttleholt adjacent to Easter Yealesborough, was a stannator along with "Thomas Elford, gent." for Plympton at the 1600 Great Court. (DRO DD 1357; Finberg 1950, 297) Walter's son, John, acquired 1/4 part of Great Evell in 1611, along with shares in at least 36 other tinworks. (DRO DD 1342) John Elford the younger, who acquired shares in Gret Hevell Beame and Ellesboure in 1563, may be a relation and an earlier Walter Elford was a stannator for Plympton at the 1533 Great Court. (Radford 1930, 243)

Other names appearing in UPV documents are associated with tin "dynasties". The name of Hele appears throughout the documentation of the tin industry and different members of the family were stannators for Plympton in nearly every Great Court. (Radford 1930, 241; Greeves 1987, 158-9) Baldwin Hele of Shaght [Shaugh], who acquired 1/5 part of Gotterknap in 1539 along with shares in eight other tinworks in Plympton stannary and 22 in Tavistock stannary, was a stannator for Plympton in the 1532 Great Court. (DRO DD 1346; Radford 1930, 241) Richard Hele was a co-owner of "Hentorhill" and "Allhalloubeame" with a member of the Strode family from 1601 until at least 1625. (WDRO 72/1034) He was a Plympton stannator at the 1600 Great Court along with three other Heles. (Finberg 1950, 297)

Apart from these major families other names are worthy of note. John Tome(s) of Shaugh, who had 1/3 share in Cranelakehed before 1640, was credited, by the anonymous writer of 1670, with an invention, dating to *c.* 1640, which stopped a stamping mill working when there was no more ore to feed it, so that the mill did not have to be continuously attended. (WDRO 72/990; Greeves 1981, 266-7) Another UPV tinner, John Am, who conveyed his 1/12 share of "Harterhole" in 1599, was the son of Harry Am and brother of William Am and in 1560, all three leased the blowing mill at Brisworthy, remains of which survive just outside the UPV area on the North bank of the R. Plym above Cadover Bridge. (SX 56026469) (WDRO 72/990/77; 72/1033; Greeves 1987, 155) Alexander Webbe, who sold his 1/3 share of North Depewourke [Deepwork] in 1560 (WDRO 72/990/33), was also involved in Brisworthy mill. Both Harry Am and Alexander Webbe were jurates for Plympton stannary at the Devon Great Court in 1574. (Pearce 1725, 241)

A particularly successful mine owner with interests in the Plym Valley area was William Stockman. In 1625, he co-owned with a member of the Strode family, "Colebeame", which may be just North of the UPV area. (WDRO 72/1034; Greeves 1981, 311) In 1595, he coined over 18,000 lbs. of tin at Tavistock and was a jurate at the Great Court of 1600. (Greeves 1987, 156; Finberg 1950, 297)

Thus several of the UPV tinwork owners in the 16th and 17th centuries were men of some importance. Membership of the Great Court implies responsibility and influence. Radford noted the democratic nature of the Parliaments (1930, 244), but Greeves points out the increasing gentrification of the stannators; by 1687/8 90% were titled. (1987, 157-8)

It is not clear how these major owners managed their UPV interests. They could have directed operations with hired labour. For example, William Stockman paid labourers to work in another of his tinworks at "Westernune" near Nun's Cross, North of Eylesbarrow. (Greeves 1987, 156) Alternatively, a tinwork could be leased to other operators. For example, in 1654, in another of Sir Richard Strode's tinworks, Blacktor also in Plympton Stannary, he and four co-owners leased it to Matthew Yandall and Roger Williams the Younger for 21 years in return for "the Tenth part or Gallon to farm of all the tinn that shall be found wrought or gottein in the said Tin worke." (Burnard 1891a, 106) However, it would be impossible to find out how many men were at work in particular tinworks.

Other names in the documents may represent the small-scale independent tinners. For example, Thomas Smythe of Shurver [?Shaugh] in 1563, Walter Gayes of Buckfastleigh in 1585, Philippe Ludbrooke als Dimvidge and Thomas Baylie of Shepistor in 1589, and Thomas Deane of Plympton St. Marie in 1599 are all described as tinners. (DRO DD 4349; WDRO 72/990/60; 72/990/65; 72/990/31; 72/990) This still does not necessarily confirm that they are working tinners; the term "tinner" was often applied loosely to avoid taxation. (Finberg 1949, 170)

By the mid-19th century, more detail is available; fortunes of mines were recorded in, for example, the Mining Journal. The number of personnel seems to have fluctuated greatly; in 1831 60 to 70 miners were employed at Ellisborough Mine, supervised by Captain Treweek, but only three or four were employed in 1841. (Cook *et al* 1974, 166,170) Men moved often from mine to mine, which may reflect fluctuating fortunes of the mines. For example, Walter Combes born in St Austell in 1782 and a miner "since a boy", worked at Ailsborough (1816-20), Whiteworks (1820), Owlacombe (1821-23 and 1825-36) and Wheal Caroline (1824-25) (Dickinson 1975, 108) JH Deacon was a major shareholder from the beginning until 1843; in 1818 he was "Purser, Bookkeeper and Manager or Chief Agent" of the Mine and in 1819, he acquired 47½ shares from WJ Albert, 11 shares from WJ Amies and an unspecified number from C Carpenter. (Cook *et al*

1974, 165; DRO 924M/B8/27) In the 1847 re-opening, the officers included John Paull of Tavistock, who had long experience of Dartmoor mining. Work at this time was supervised by Captains Spargo, Floyd and Gregory. (*op.cit.*, 170-2)

Thus documentary evidence can link many names with UPV tinworks, though it seems to identify mostly the entrepreneurs rather than the working tinners. Furthermore, it adds little to the argument that tin-working was often an occasional activity, supplementary to other interests. The problem of the relationship between the tinner and the agricultural community will be addressed further below. (see chapter 6) Thus the Am family, jurates in the stannary parliament and with interests in tinworks and the Brisworthy blowing mill may be considered to be predominately tinners. Likewise John Tomes of Shaugh, who owned shares in at least one UPV tinwork and made improvements to the stamping procedure, may also have concentrated on tinworking. Diversification is also indicated in UPV, though mostly within the entrepreneurial class; thus Strodes and Woollcombes had interests in tinworks in UPV and elsewhere as well as Trowlesworthy amongst other properties. However, it is tempting to suggest as a working farmer/tinner, Elie Shullibeare, who leased Ditsworthy in 1553 and who may be the same person as Elizeus Shullibeare, stannator for Plympton in 1574. (WDRO 70/156; Pearce 1725, 241)

Finally. the possible role of the Church should be considered. Finberg noted the participation of some Abbots of Tavistock in the tin industry. Following his successful supervision of Devon silver mines, Abbot Champaux was appointed warden of the Devon Stannaries in 1319, and later "farmed" or leased the revenues of the Stannaries for £100 per year. (Finberg 1949, 163) In 1470, Abbot John Dynyngton owned 1/3 part of a tinwork in Bruggepole. (*op.cit.*, 172) A connection might be expected between UPV tin-works and Buckland Abbey. The Abbey was involved elsewhere, though probably only as a property owner; the Abbot leased a tin mill at Gnatham, near Horrabridge, some time before 1538. (Greeves 1981, 150) However, no evidence has been found to link UPV tinworks with Buckland. Finberg minimises the influence of the abbeys and concludes that tin mining was only of minor importance to Tavistock Abbey. (1969, 167)

5.3 STREAM-WORKING

The early preference for alluvial tin over lode ore because if its greater accessibility and higher tin content has already been noted. (See p.347) Pure cassiterite contains 78.6% metallic tin and alluvial deposits can approach this figure, whereas lode ore rarely contains more than 70% tin. (Moor 1928, 1) Some low grade ore could only reach 65% tin content after crushing and concentration. (Tylecote 1986, 44) This minimizes the dressing process, as such pure ore requires little refinement prior to smelting. (See below section 5.7.1)

It is likely that the earliest method of streaming, which would leave no trace in the archaeological record, was the collection of cassiterite pebbles from the surface and the rounded cassiterite pebbles from structure B of the Bronze Age settlement at Trevisker Round, St. Eval, Cornwall might be typical examples. (Shell 1979, 263 Plate 1)

However, later methods were more complicated and it is a mistake to underestimate the efforts involved in tin streaming. It is commonly believed that streaming merely involves the sorting of panfuls of gravel, in a similar way to the popular notion of gold-panning. Water sorting is undoubtedly essential to the operation: in the process of "vanning", described below, Cornish tinners sampled tin content in a flow of water on their shovels, according to the same principle applied in panning. On a larger scale, cassiterite pebbles in a layer could be isolated from alluvial silt and gravel by the sorting action of a stream of water. However, this ignores the amount of overburden, which had to be removed before reaching the tin-bearing stratum, as well as the management of water supply.

Before a consideration of the archaeological evidence, some general comments on methods may be made. The essential requirements in a stream work are the removal of overburden and the provision of a stream of water, in which to separate cassiterite from other sediments. It is assumed that, in general, work proceeded upstream, so that sediments washed away in the elutriation process would not be redeposited over an area of future work. This may be an over-simplification: each particular streamwork was probably worked upstream, but individual streamworks within one river system may have been worked at different times. Streamworks may be subdivided into workings on alluvial and eluvial placers. It is suggested below that the distinction between the archaeological remains may not be very significant, but, following Gerrard's classification (1986), it is proposed to discuss each separately.

5.3.1 Archaeological Evidence of Alluvial Streamworks.

The remains of the efforts made by streamers are still visible in UPV and in the moorland stretches of other Devon rivers, notably the Yealm, Erme and Avon. The structures of later tin works and other activities superimposed on tin streaming remains hinders interpretation. For example, the 19th century Engine Leat, **Mon 1075**, constructed to supply Eylesbarrow Mine, cuts through tin streamworks in several tributaries of the R Plym: Deadman's Bottom, Evil Combe and Drizzle Combe. The activities of rabbit warreners have also modified the appearance of streamworks; pillow mounds, **Mons 438, 583, 857, 861** and **863-4**, located below the tinners' cliff may have been built by enlarging waste heaps, while another bury, **Mon 4**, which lies across parallel waste ridges, was probably constructed out of waste gravel.

Within UPV, circular stone-lined shafts occur in areas of streamworking and would seem to be associated with them. Thus **Mons 993, 994, 995** and **1003** occur immediately above the streamworks on the left bank of the Plym at its confluence with Shavercombe Brook, on the edge of eluvial gullies. However the remains which are the most widespread in the valley, covering the floor of the Plym and all its tributaries are the waste heaps, consisting mostly of the overburden, but also the larger stones from the tin-ground, which were too heavy to be carried away in suspension. The waste heaps are often grass- or heather-covered but some are also bare of vegetation to reveal the stony composition.

The configuration of the waste heaps may give some indication of the method of working the placers, but it is important to note that the heaps reflect the situation at the end of working and not necessarily "floruit" use. The non-survival of what may have been a significant wooden element, for example, in launders, may also confuse the streaming evidence. Furthermore, the original character of the streamwork may even have been altered by measures designed to minimize damage to estuaries and harbours, such as removing waste to "old Hatches" and "Tipittes". (Radford 1930, 239)

These heaps were broadly divided into two categories by Greeves. (1981, 132) In each category, the extent of working is marked by a steep cliff edge, roughly parallel with the river. The first type, which seems to follow a regular and systematic plan, consists of parallel or concentric ridges, separated by well-defined channels. (Greeves 1981, 132) Three sub-divisions of this category have been identified on Bodmin Moor by Gerrard, based on the profile of the mound or presence of a retaining wall, and examples of each can be found in UPV. (Gerrard 1986, 207-215) Thus "cuestaworks" consist of parallel ridges with a steep scarp slope facing downstream and a gentler slope upstream, to form a "cuesta-shaped" profile. (*op. cit.*, 207) The banks are either overlapping, with one bank partially overlying the next one downstream, or they are separated by channels. (*ibid.*) Secondly, "parallelworks" consist of parallel, steep-sided and symmetrical linear banks, separated by channels. (*op. cit.*, 211) Thirdly, "retained dump-works" also consist of parallel linear banks, but with a vertical retaining wall on the upstream side and a gentler slope downstream to form an asymmetric profile. (*op. cit.*, 214)

The appearance of these parallel formations may indicate the method of working. Thus Greeves suggests that the tinners progressed upstream, dumping waste material behind them. (1981, 134) (See Fig. 5.3a) In the case of the retained dump-works, the wall-face would prevent waste from falling back into the working area. However, apart from the wall-face retained dump-works and parallelworks are basically the same. Gerrard suggests that the distinction between these two types and the cuestaworks results from the use of wheelbarrows at the latter as opposed to shovels. (Gerrard 1986, 207, 211) Thus wheelbarrows used for dumping require a more gentle slope, while tipping up at the end of the barrow-run might produce a relatively-steep scarp slope downstream. (*ibid.*) (See Fig. 5.3b) He also noted ruts, possibly made by barrows on cuestaworks at, for example, Minzies Down, St Neot parish. (Gerrard 1986, 208 Fig. 5.6) Thus appears that the three types result from the same method of working but with particular local preferences, depending on perhaps the amoumt of overburden. (*op. cit.*, 213)

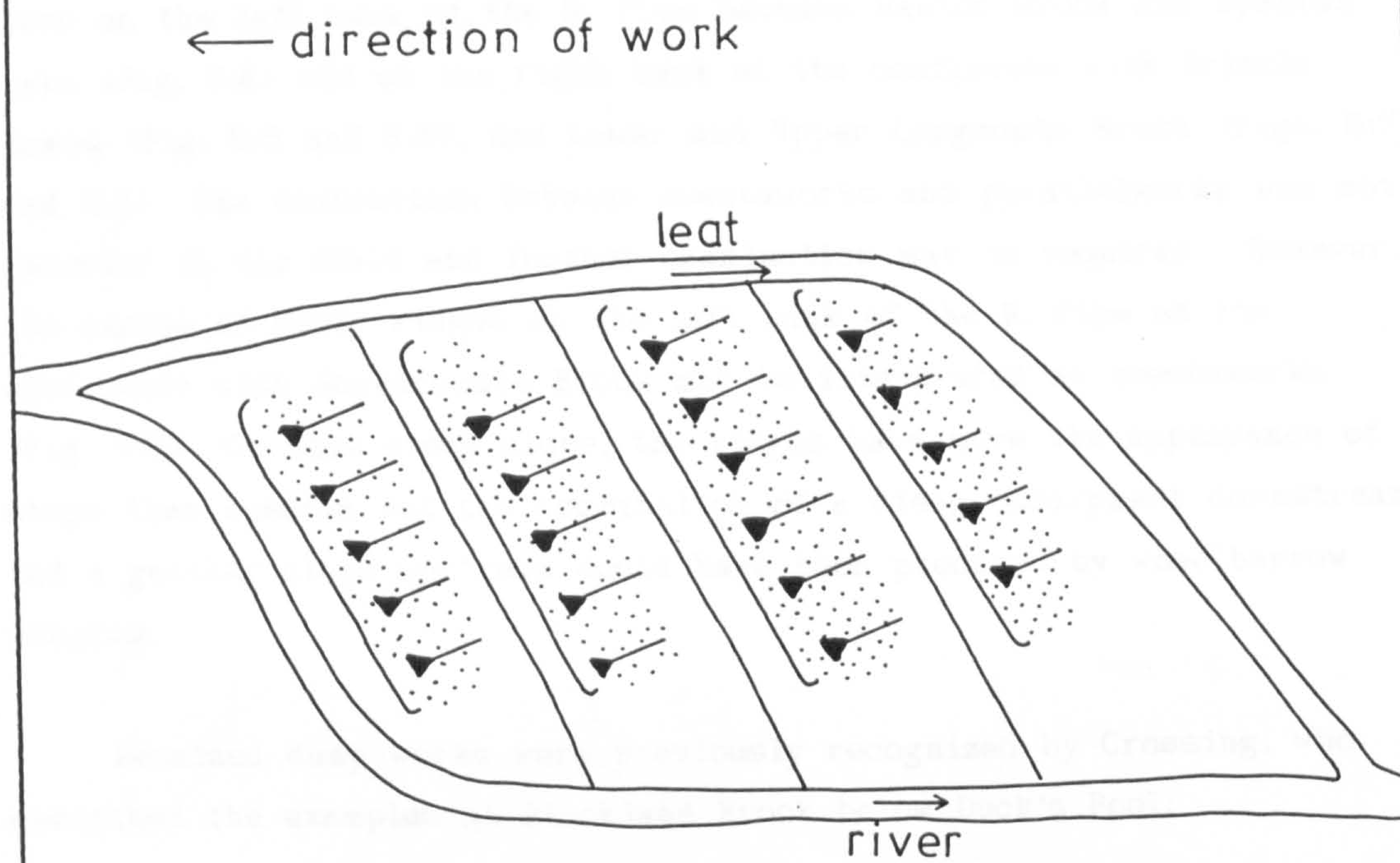


Fig. 5:3a The formation of parallel ridges
(after Greeves 1981, fig 3)

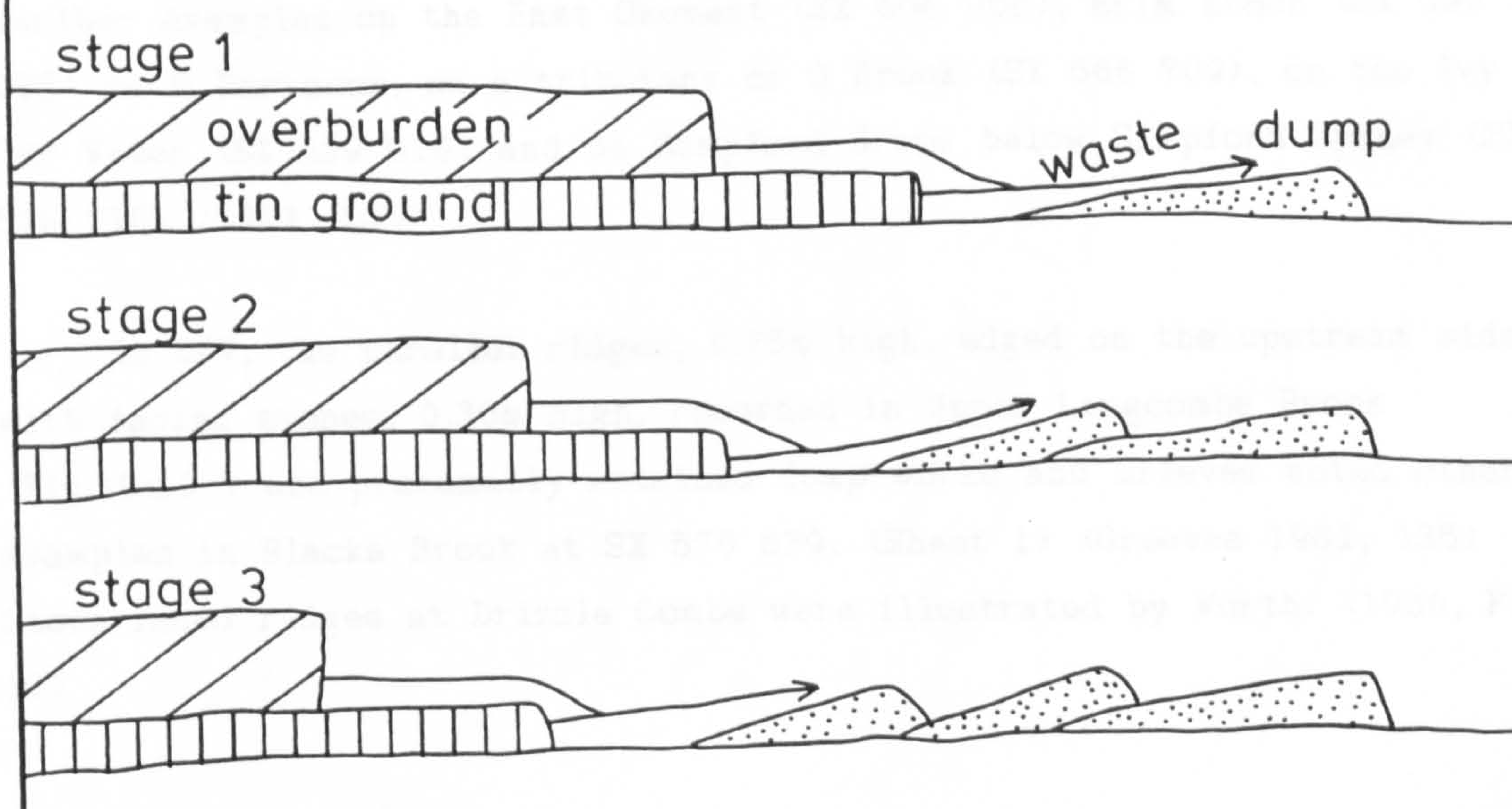


Fig. 5:3b The formation of cuestaworks
(after Gerrard 1986, fig 5.7)

Parallel formations occur throughout UPV and good examples may be seen on the left bank of the R. Plym between Hentor Brook and Spanish Lake (Fig. 5:4) and on the right bank at its confluence with Drizzle Combe (Fig. 5:5 and 5:6), and Lower and Upper Langcombe Brook (Figs. 5:7 and 5:8) The distinction between cuestaworks and parallelworks was not recorded in the field and further examination may be required. However, the series of stony ridges on the left bank of the R. Plym at its confluence with Shavercombe Brook may be interpreted as cuestaworks. (Fig. 5:9) On this steep slope, the ridges have more the appearance of steps than cuestas but the combination of a steep escarpment downstream and a gentler slope upstream could have been produced by wheelbarrow dumping.

Retained dump-works were previously recognized by Crossing, who described the examples at Blacklane Brook below Duck's Pool:

> "These remains of the tinners consist of the usual heaps of stones, but it is observable that they are piled up with a great degree of regularity, being in fact laid in courses, thus forming mounds of stone, faced with a dry wall." (Crossing 1890-1, 175)

Other examples, noted by Crossing (*ibid.*) on the Erme, above Drylake are illustrated in Woods' Dartmoor Stone. (1988, 250) Greeves records further examples on the East Okement (SX 606 908), Brim Brook (SX 590 875) on N Dartmoor, on a tributary of O Brook (SX 666 709), on the Ivy Tor Water (SX 629 916) and on Sampford Brook below Sampford Spiney (SX 526 716) (1981, 135)

In UPV, the parallel ridges, 0.75m high, edged on the upstream side with facing stones, 0.30m high, recorded in Upper Langcombe Brook (Fig. 5:10) are presumably retained dump-works and Greeves noted other examples in Blacka Brook at SX 570 639. (Sheet 1) (Greeves 1981, 135) Stone-faced ridges at Drizzle Combe were illustrated by Worth. (1930, Fig. 17)

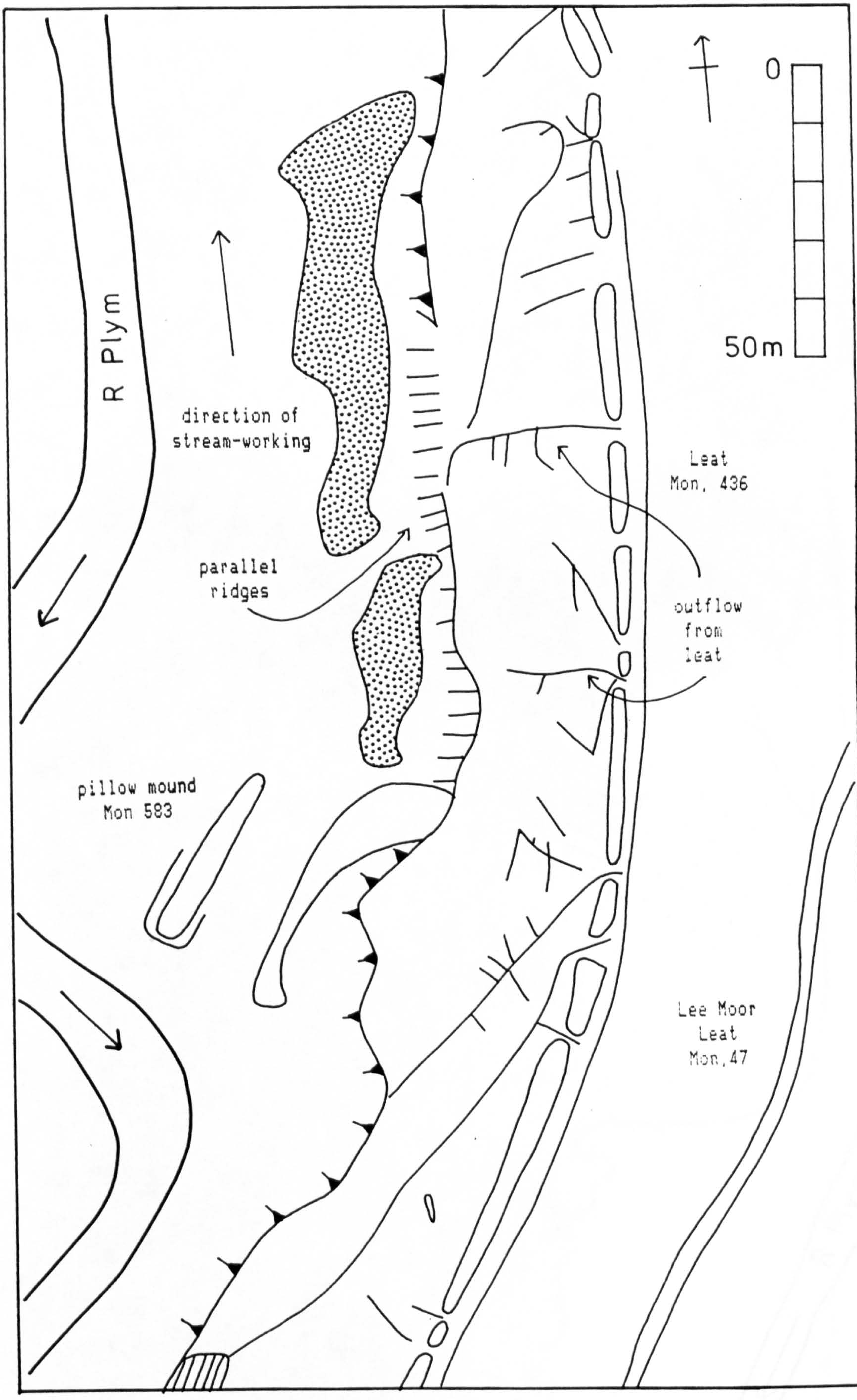


Fig. 5:4 Alluvial streamworks in R Plym
between Hentor Brook and Spanish Lake

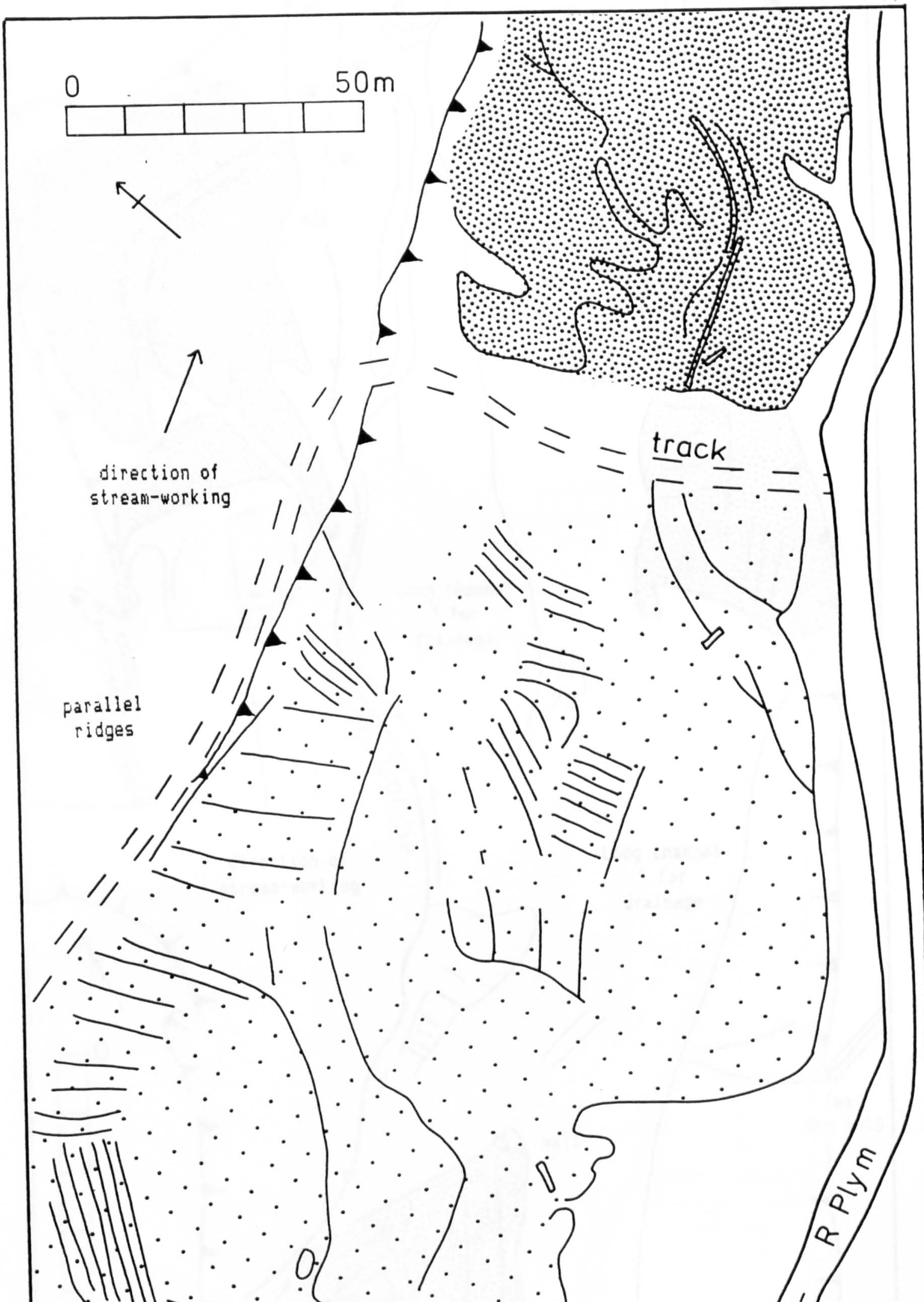


Fig. 5:5 Alluvial streamworks in R Plym at its confluence with Drizzle Combe

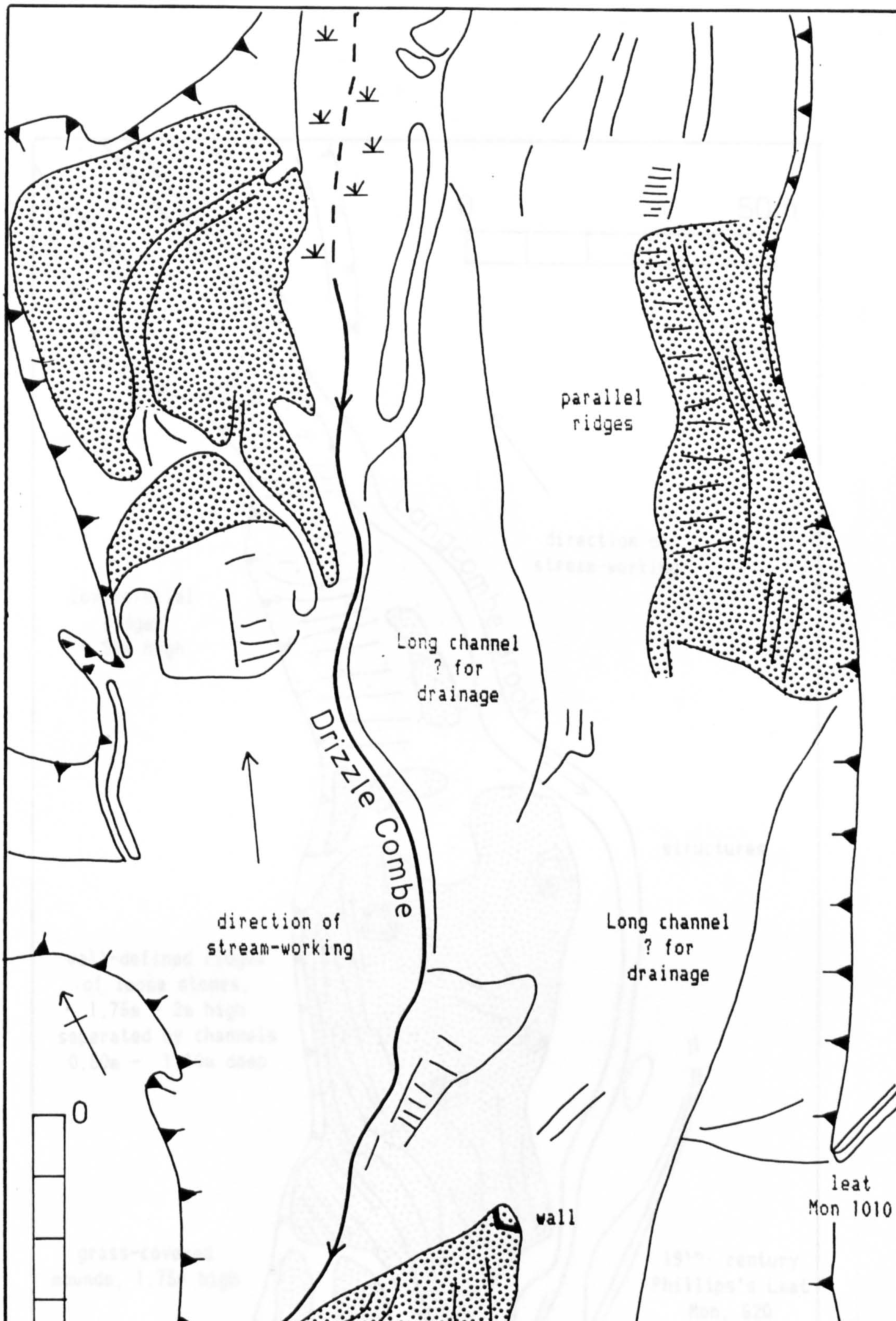


Fig. 5:6 Alluvial streamworks in lower Drizzle Combe

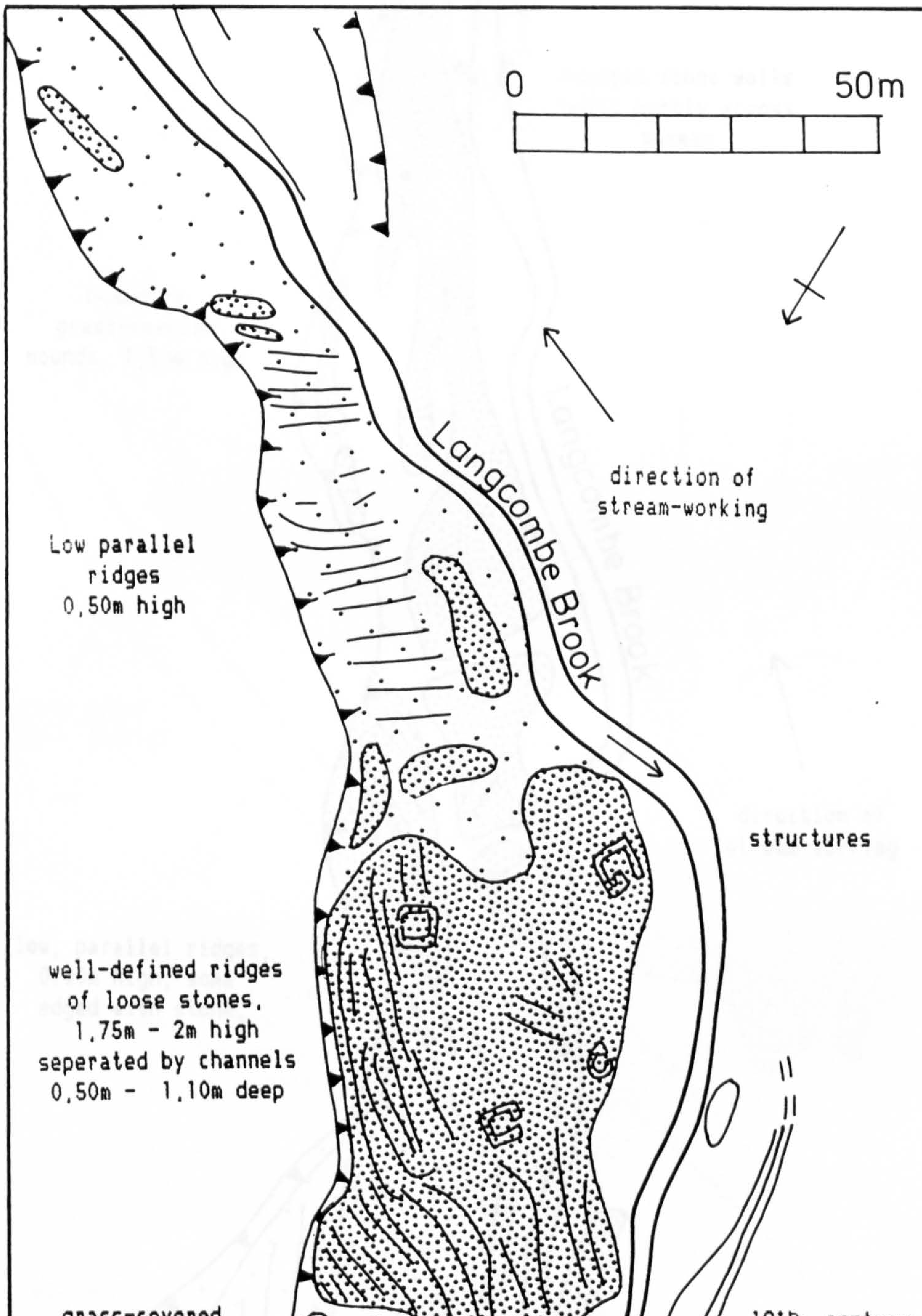


Fig. 5:7 Alluvial streamworks in lower Langcombe Brook

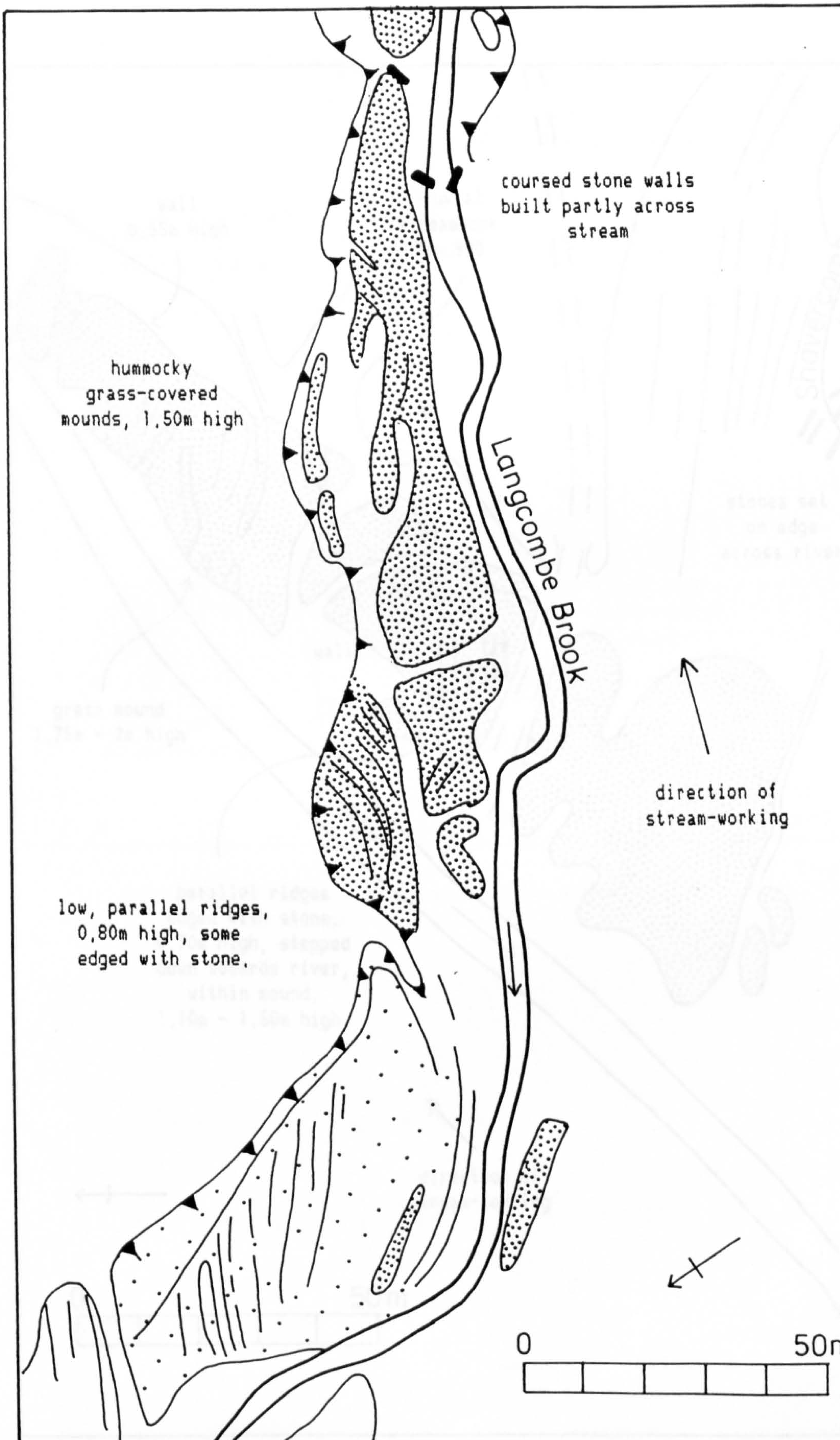


Fig. 5:8 Alluvial streamworks in upper
Langcombe Brook

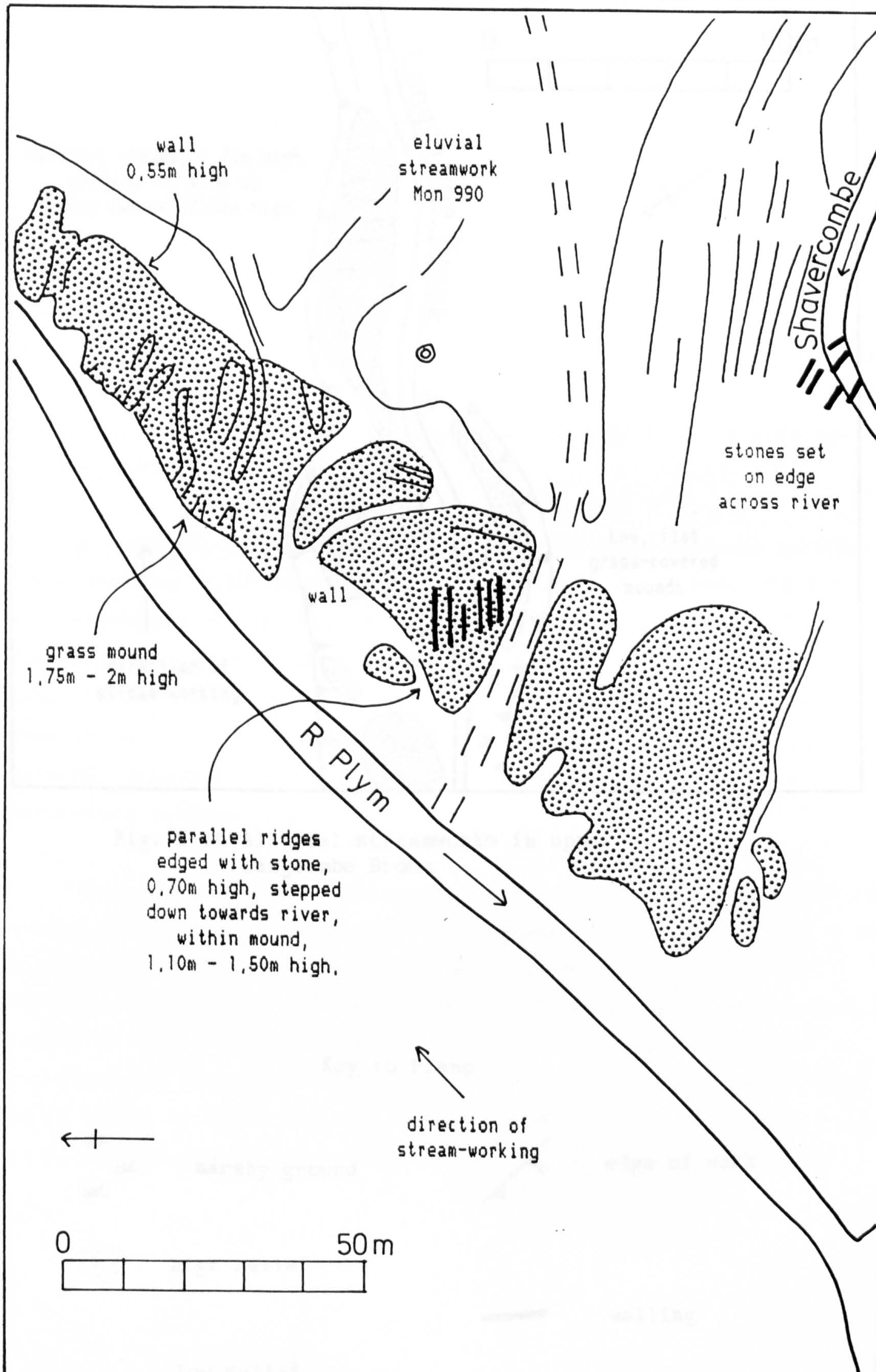


Fig. 5:9 Alluvial streamworks in R Plym at its confluence with Shavercombe Brook

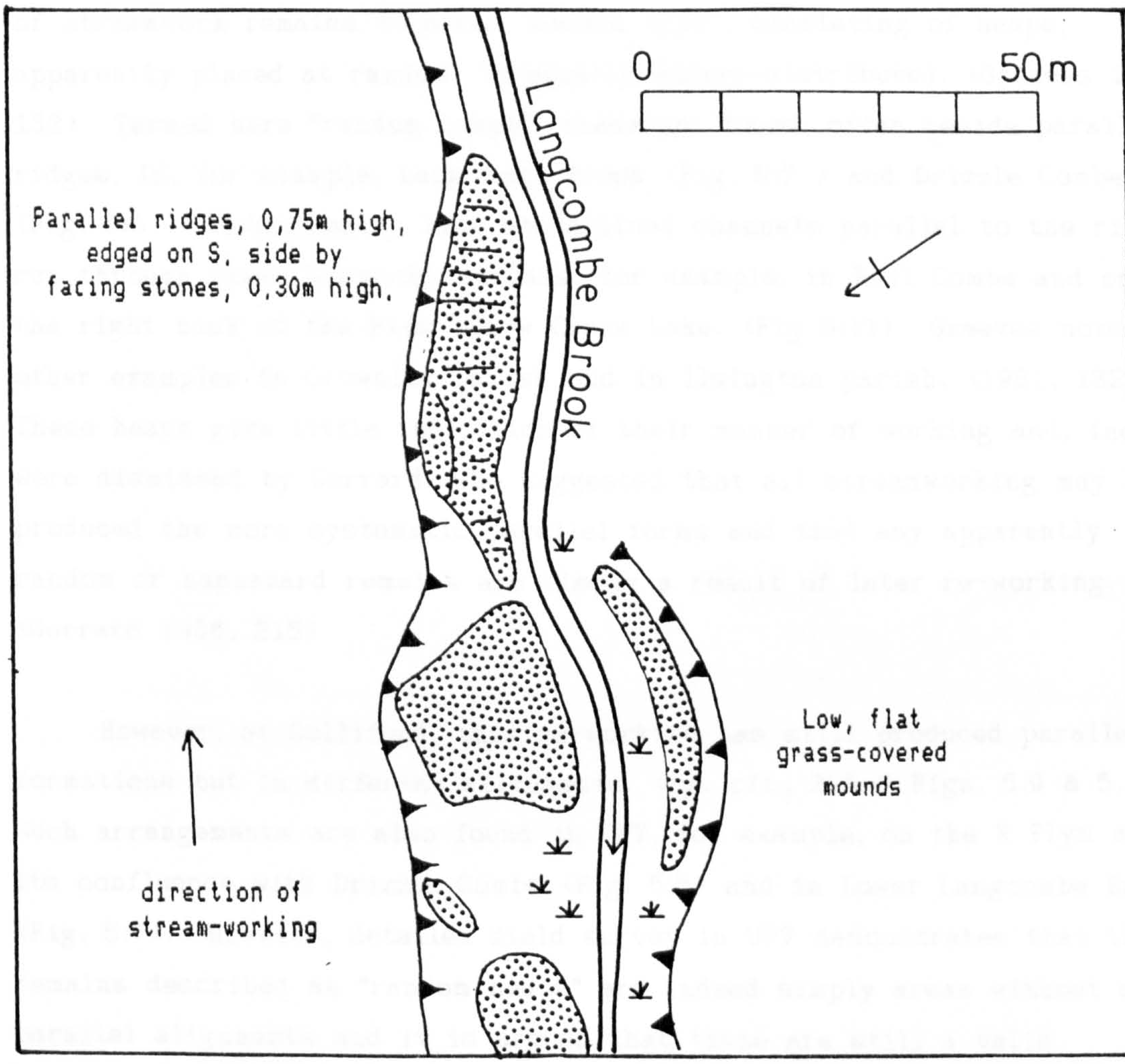
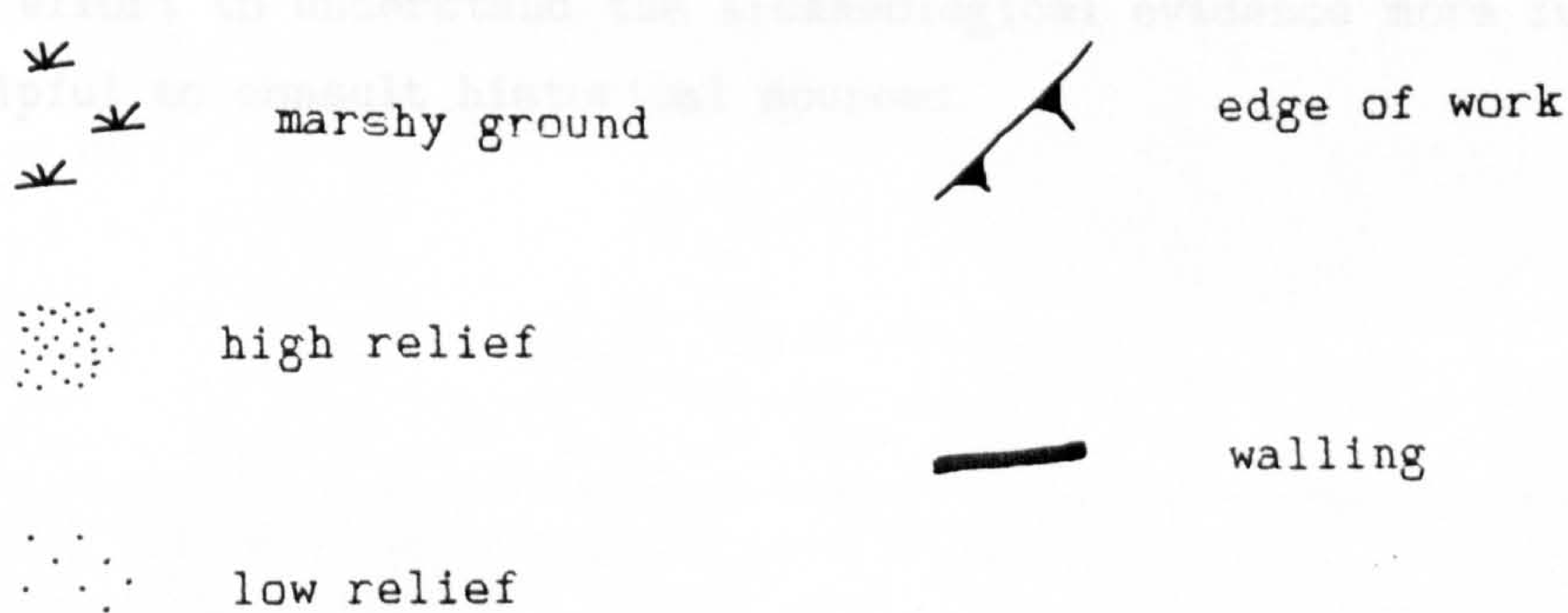


Fig. 5:10 Alluvial streamworks in upper Langcombe Brook

Key to Plans



While parallel formations occur widely throughout UPV, another form of streamwork remains (Greeves' second type), consisting of heaps, apparently placed at random, is equally widely-distributed. (Greeves 1981, 132) Termed here "random heaps", these are found, often beside parallel ridges, in, for example, Langcombe Brook (Fig. 5:7) and Drizzle Combe (Fig. 5:6) Occasionally long stone-lined channels parallel to the river run through these hummocky spreads, for example, in Evil Combe and on the right bank of the Plym below Crane Lake. (Fig 5:11) Greeves noted other examples in Crownley parish and in Ilsington parish. (1981, 132) These heaps give little indication of their manner of working and, indeed, were dismissed by Gerrard, who suggested that all streamworking may have produced the more systematic parallel forms and that any apparently random or haphazard remains are simply a result of later re-working. (Gerrard 1986, 215)

However, at Colliford, this re-working has still produced parallel formations but in different alignments. (*op. cit.*, 216-7 Figs. 5.9 & 5.10) Such arrangements are also found in UPV, for example, on the R Plym at its confluence with Drizzle Combe (Fig. 5:5) and in Lower Langcombe Brook (Fig. 5:7). However, detailed field survey in UPV demonstrates that the remains described as "random heaps" are indeed simply areas without any parallel alignments and it is argued that these are still a valid streamwork category.

Thus, the UPV field evidence supports Gerrard's contention that much greater complexity is implicit in the streamwork remains than was once thought and that some indication of working practices is revealed. However, it remains to determine whether the random heaps are, indeed, a result of re-working or whether they indicate a different approach to tin-streaming from that which produced parallel ridges. However, first, in an effort to understand the archaeological evidence more fully, it may be helpful to consult historical sources.

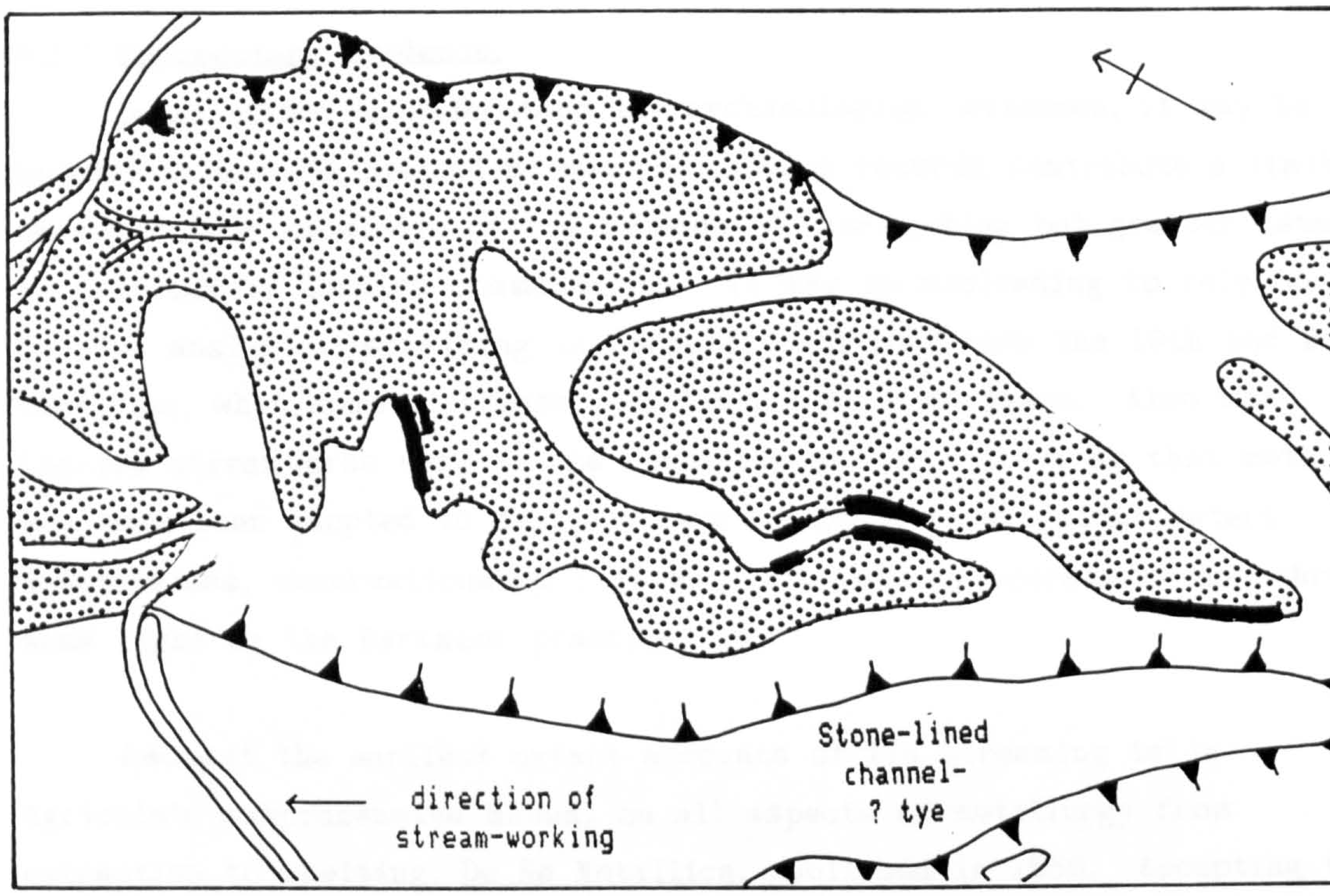
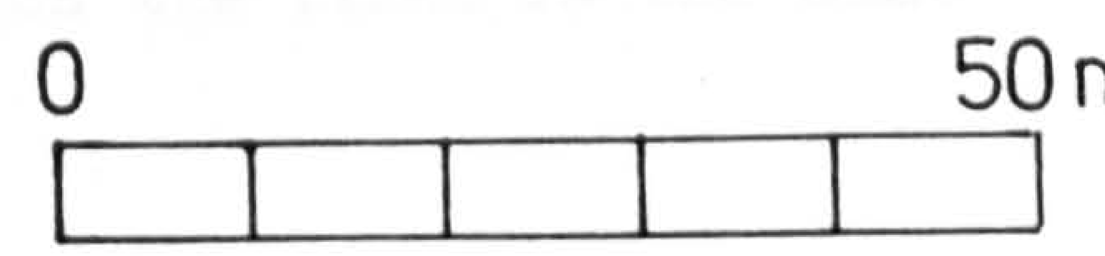


Fig.5:11a Alluvial streamworks in Evil Combe



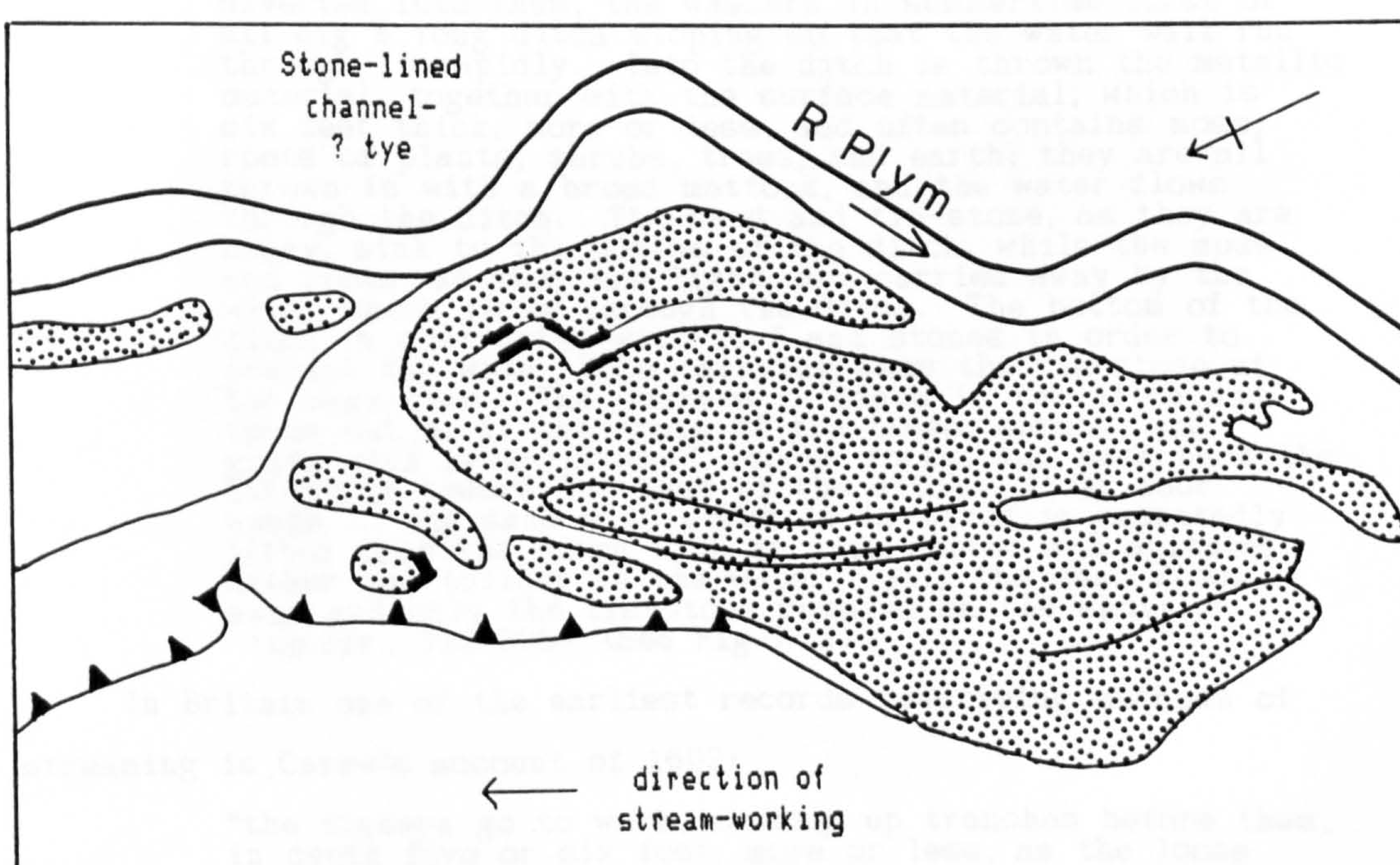


Fig.5:11b Alluvial streamworks in R Plym
below its confluence with Crane Lake

5.3.2 Documentary Evidence.

In an effort to understand the archaeological evidence, it may be helpful to consult historical records. Devon records contribute a limited amount to our knowledge of the methods of tin-working but greater detail is provided by Cornish commentaries. It may be misleading to rely on Cornish analogies; streaming in Cornwall continued into the 19th and 20th centuries, when some elaborate operations were undertaken. Also many Cornish streamworks were in the lower reaches of valleys so that methods may have been adopted to deal with marine deposits and tidal waters. Nevertheless, observations of 17th and 18th century operations may throw some light on the Dartmoor practice.

Amongst the earliest extant accounts of tin streaming is in Agricola's comprehensive manual on all aspects of metallurgy from extraction to smelting, De Re Metallica, published in 1556. Accepting the caveat, which qualifies the Cornish evidence, his record of contemporary practice in the Erzegebirge may contribute to an understanding of tin streaming. He describes eight methods, of which the first is the most relevant. (1950 ed., 336)

> "In districts which contain this material, if there is an abundant supply of water, and if there are valleys or gentle slopes and hollows, so that rivers can be diverted into them, the washers in summertime first of all dig a long ditch sloping so that the water will run through it rapidly. Into the ditch is thrown the metallic material, together with the surface material, which is six feet thick, more or less, and often contains moss, roots of plants, shrubs, trees, and earth; they are all thrown in with a broad mattock, and the water flows through the ditch. The sand and tin-stone, as they are heavy, sink to the bottom of the ditch, while the moss and roots, as they are light, are carried away by the water which flows through the ditch. The bottom of the ditch is obstructed with turf and stones in order to prevent the water from carrying away the tin-stone at the same time. The washers ... stand in the ditch and throw out of it the roots of the trees, shrubs, and grass with seven-pronged wooden forks, and push back the tin-stone toward the head of the ditch. After four weeks ... the sand with which it is mixed is repeatedly lifted from the ditch with an iron shovel and agitated hither and thither in the water, until the sand flows away and only the tin-stone remains on the shovel." (*op.cit.*, 336-339) (See Fig.5.12)

In Britain one of the earliest records describing methods of streaming is Carew's account of 1602:

> "the tinners go to work, casting up trenches before them, in depth five or six foot, more or less, as the loose ground went, and three or four in breadth, gathering up such shoad [lumps of ore] as this turning of the earth doth offer to their sight. If any river thwart them, and that they resolve to search his bed, he is trained by a new channel from his former course." (1811 ed., 28)

A—Stream. B—Ditch. C—Mattock. D—Pieces of turf. E—Seven-pronged fork. F—Iron shovel. G—Trough. H—Another trough below it. I—Small wooden trowel.

Fig. 5:12 Stream-working depicted by Agricola (from Agricola 1950 ed 337)

In 1778, Pryce provided a more detailed description of work and equipment in Cornish tin streams. At the beginning of the process the tinner:

> "sinks a hatch [shaft] three, five or seven fathoms deep on to the rocky "shelf" of clay bed on which the Tin Gravel lies stratified in the bottom of the valleys." (1778, 132)

On reaching the cassiterite-bearing layer, the tinner tested the quality of the deposit by "vanning", in which he washed a sample of the layer placed on his shovel in a flow of water. If a sufficient amount of cassiterite was revealed, work would proceed:

> "he then goes down to the lowest or deepest part of the valley, and digs an open trench, like the tail or low slovan of an adit, which he calls a Level, taking the utmost care to lose no levels in bringing it home to the Stream. This level serves to drain and carry off all water and waste from the workings, in proportion as he hath a weak or powerful current of water to run through it. ... the streamer carries off what he calls the Overburden, viz. the loose earth, rubble, or stone which covers the stream." (*op.cit.*, 133)

Pryce then describes various methods of dealing with superfluous water, from scooping it out by hand, or using a hand pump to discharging it into the "level" by a water-powered rag and chain pump. Finally the cassiterite was sorted by elutriation:

> "his men are digging up the Stream Tin, and washing it at the same time, by casting every shovel full of it, as it rises, into a Tye, which is an inclined plane of boards for the water to run off, about four feet wide, four high, and nine feet long, in which with shovels, they turn it over and over again under a cascade of water that washes through it, and separates the waste from the Tin, till it becomes one half Tin." (*ibid.*)

During this process the denser tin collected at the head of the tye; the waste, which gathered at the tail, was eventually washed downstream.

Finally, it may be appropriate to consider the description supplied by Hitchens and Drew. Although published in 1824, their account refers to a stream work with a shallow overburden and may have some relevance to the UPV.

" a stream of water is conducted on the surface to that spot where [the tinner] intends to begin his operations. A level is also brought home to the spot from below, as deep as the ground will permit, and the workings require, to carry off the sand and water. The ground is then opened at the extremity nearest the sea, or the discharge of water; from which place the streamers ... proceed towards the hill. On the ground which is laid open, the stream of water is turned in from the surface, which, running over an almost perpendicular descent, washes off the lighter parts of such ground as had been previously broken by picks, carrying them through the underlevel, which is called the *tye*, and leaving behind the sandy ore, and such stones as are too heavy to be thus removed. In this stream the men ... continue to stand, keeping the sand and gravel at the bottom in motion. From it they select the larger rubbish, throwing it on one side, picking from their shovels such shode as appears. The precipice over which the water runs is called the *breast*; the rubbish thrown away is called *stent*; the sand, including tin, is called *gard*; the walls on each side of the tye are called *stiling*; and the more worthless parts which are driven away by the stream are called *tailings*. In this manner they continue to dig or break their ground until the whole is exhausted, which is sometimes the work of many years.
(Hitchens and Drew 1824, 1, 603-4))

5.3.3 <u>Interpretation of the Archaeological Evidence</u>

These accounts are instructive and offer some assistance in the interpretation of the archaeological remains. Thus it may be suggested that the tinners "casting up trenches before them", described by Carew, would have produced something similar to the parallel formations, described above. Gerrard suggests that Hitchens and Drew's description is also appropriate and that the "stiling" probably corresponds to the wall-face in retained dump-works. (Gerrard 1986, 214)

This contrasts with the method of "hatching" described by Pryce, in which a "hatch" or shaft is sunk "three, five or seven fathoms deep" down to the tin-bearing stratum. (1778, 132) It is possible that the spoil produced while sinking a shaft might be deposited in a more irregular pattern. Therefore, it may be suggested that the distinction between parallel ridges and random heaps arose from the use of different methods.

Greeves found a distinction in historical records between "streamworks" and "hatchworks". (1981, 129-130) Thus sometimes both terms are listed as if they are separate operations. For example, Greeves cites (1981, 130) an enactment of the 1574 Great Court,which states that:

> "it shall not be lawful ... to Dig or Work for Tin in any Stream Work within threescore Foot of the Main, or great fresh Rivers ... nor shall work any Hatchwork within four and twenty Foot of any the Rivers aforesaid."
> (Pearce 1725, 243)

The remains of a possible shaft were found at Pentewan stream works, Cornwall in 1852. The oak framework of an old square-sectioned shaft was uncovered about 3m below the surface. The timbers of the framework were joined by mortices and tenons, and the interstices were filled with interlaced oak twigs. (Penhallurick 1986, 166; Hamilton Jenkin 1962, 154) The shaft was not measured or drawn at the time of discovery, but Penhallurick calculates that it was about 4.5m deep. (1986, 166) The discovery of a bronze "chisel" and a MBA socketed spearhead may indicate the antiquity of this shaft, though the association between the shaft and the bronzes is questioned by Shell. (1979, 256) Possible parallels in UPV are the circular structures, **Mons 993, 994, 995 and 1003** above Shavercombe Brook at its confluence with the R Plym. Only 0.50m to 0.75m deep at present, it is possible that these are filled shafts, lined with stone, in the absence of wood.

However, according to Pryce's description, a hatch is a preliminary stage in the streaming operation. If the tin ground at the bottom of a hatch looked profitable, work commenced on a large scale. (Pryce 1778, 133) It might appear that the hatch would be destroyed by subsequent work. If the hatch found good tin ground, Pryce's tinner "goes down to the lowest or deepest part of the valley and digs an open trench". Presumably from there, he proceeded upstream and, removing the overburden, would have dug through the hatch.

Furthermore, the shafts at Pentewan and Shavercombe seem to be rather elaborate constructions to be merely part of a preliminary operation. This suggests that these shafts represent a separate method distinct from the parallel ridge method of stream working and from Pryce's "hatches".

If well-defined shafts belong to a separate category, it may still be possible that simple pits served as hatches with the spoil thrown into hummocks. It is important to note that tin-bearing placers could develop in pot-holes or channels on the valley floor and did not necessarily spread across a whole valley. Therefore, it may have been necessary to dig trial pits through the overburden to locate tin ground. Once found, the systematic parallel ridge approach could be adopted. Hummocky spreads of random heaps may thus represent areas of alluvium without a cassiterite placer below. Gerrard identified pits, associated with waste dumps, leats and drainage channels, at Colliford and Minzies Down, Bodmin Moor as possible hatchworks. (1986, 203) Gerrard concluded from their limited extent that these were trials, though probably relatively recent re-workings. (*ibid.*)

It is also possible that the distinction between parallel ridges and random heaps is connected with methods used in relation to the nature of the deposit. According to the method of "ground-sluicing", recommended for small-scale 20th century alluvial works, a trench is dug in the ground, through which water is allowed to flow, so that light waste is carried away and cassiterite remains in the trench in a relatively concentrated condition. (Moor 1928, 79) In a Malaysian ground-sluice or "lampan" the tin ground in the trench and on the slope above could be loosened with hoes and moved manually into the flow of water. (Warnford-Lock 1907, 113) However, under a head of water or with the use of a concentrated jet of water, such as in a hose-pipe, the force of the water might be sufficient to loosen the tin ground and wash it into the trench: "a few hundred feet of three to four inch iron "down pipe" terminating in canvas hose and a one-inch nozzle would do the work of twenty coolies." (*op.cit*, 114) The effect may not have been dissimilar from the use of the high pressure hose on Californian gold placers, invented in 1852. (Simonin 1869, 442) (See Fig. 5.13) Ground-sluicing or "hushing" was used by the Romans in alluvial gold deposits especially those in high-level alluvium, such as the R Sil in NW Spain. (Davies 1935, 18) Water for sluicing was carried for several miles in canals and stored in huge cisterns before use. (*ibid.*)

There seems to be no reason why such methods could not be employed in UPV. Sluicing depends on a good head of water and presumably this could be easily obtained in streams rising at greater altitudes. However, modifications could also be made to increase the velocity of the stream.

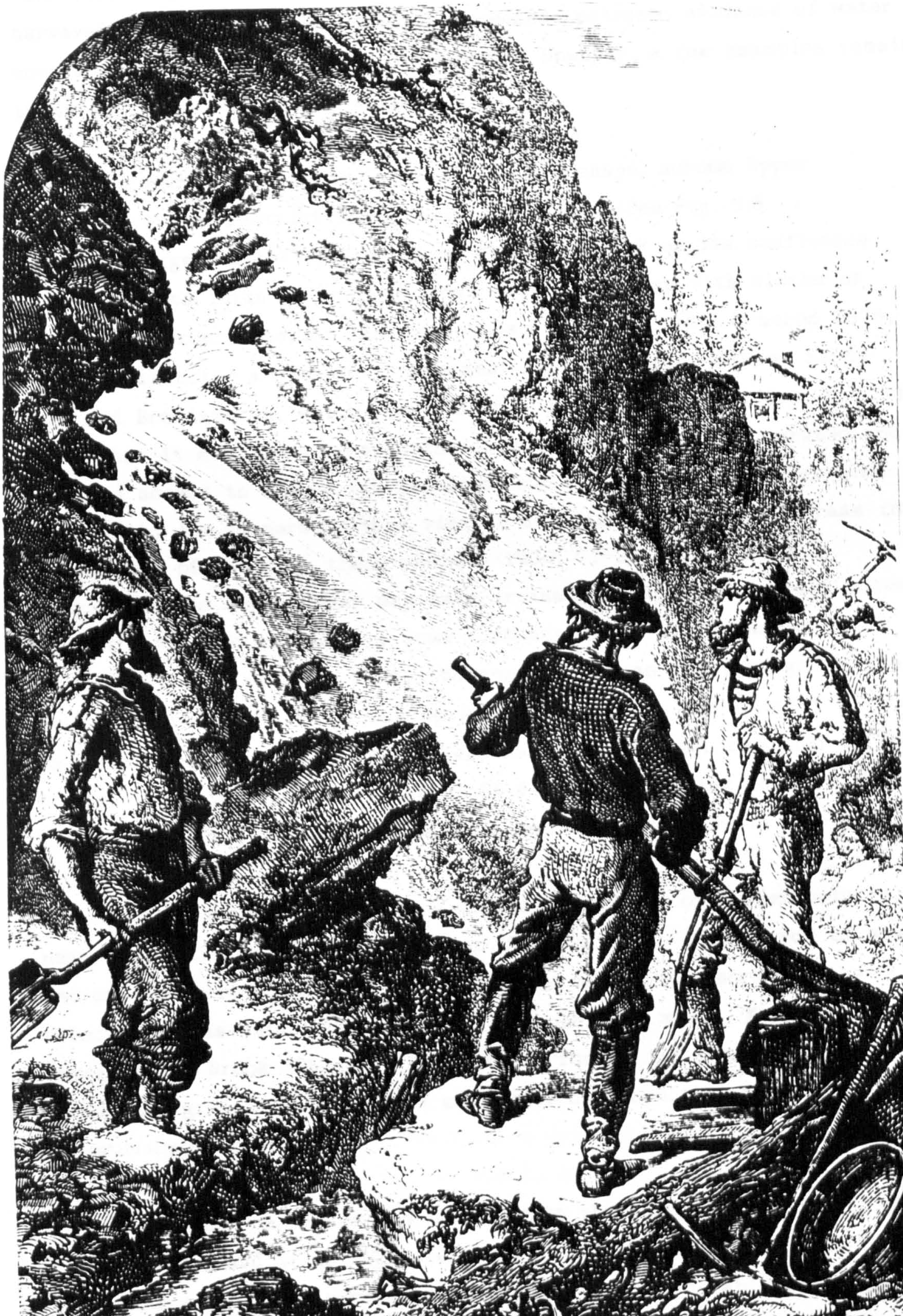


Fig. 5:13 Hushing in Californian gold placers
(from Simonin 1869 fig 150)

Unfortunately many of the devices used to control water will not have survived. Thus, as stream-working proceeded upstream, evidence of water control would mostly have been destroyed. However, a few examples remain in UPV to illustrate this practice.

Thus two coursed walls, arranged in a V-shape, across Upper Langcombe Brook. restrict the flow of the river. (See Fig. 5:8) Crossing suggested that the sides of the Wallabrook at its confluence with the North Teign on Scorhill Down were "walled up with blocks of granite" in order to drain the swamp above. (1890-1, 180; Ormerod 1876, 111) Worth noted a similar arrangement on the E Dart, between Sandy Hole and Broadamarsh, which resulted in a deepening of the river bed. He noted that it must have lowered the saturation level of the marshes and provided access to deeper tin deposits, but suggested that it was also designed by the tinners "with a view to assuring an efficient stream for the purpose of removing their waste". (1930, 71-2) Thus in Upper Langcombe, this arrangement may have drained the alluvial deposit above; the streamwork continues for some distance above this point up to Langcombe Head. However, it may be more likely, as Worth suggests, that walling up the river banks was designed to increase the velocity of the water for washing. (1930, 72) Other examples have been recorded on the R. Avon below the clapper bridge at SX 656 663 (Crossing 1889-90, 7), on Small Brook, West Okement and on Brim Brook. (Greeves 1981, 138)

Another example may be seen in the lower part of Shavercombe Brook, near its confluence with the R Plym. (See Fig. 5:9) Here, a row of slabs, set on edge across most of the stream. may also have increased the velocity of the water. Finally, the large earthen mound, **Mon 581**, across Upper Hentor Brook (Sheet 9) may have performed the same function, though its great size (3m high) seems out of proportion to the insignificant brook.

These three examples may demonstrate the practice of altering the flow of water and it is suggested that this was done in order to facilitate sluicing. Gerrard demonstrates the considerable ingenuity of the tinners in controlling the velocity of the water in eluvial streamworks; for example, in altering the shape of the dam and in varying the angle of the work-area and it is likely that similar efforts will have been made in alluvial streamworks. (Gerrard 1986, 200-226) (see below p.395) Presumably, part of this more swiftly-flowing stream would then have been diverted and conducted directly to the streamworks, though any trace of a leat would have been destroyed by later work. Pressure of water at the work-face could have been increased further by directing the water into a narrow wooden launder or even some form of hose-pipe

Other leats may occasionally have provided additional force of water. Thus the leat, **Mon 1010**, captured water from the R Plym above 320m or possibly 328m OD, followed the contour for a distance, apparently using the large standing stone terminating the stone row **Mon 1011a**, as a landmark, and then rushed downhill to a part of the Drizzle Combe streamworks, at about 309m OD. (Sheet 25; Fig. 5:6) Other fragments of leats survive elsewhere on top of the tinners' cliff, for example **Mon 1171** at Deadman's Bottom, while the walls, **Mon 1007** above Drizzle Combe at its confluence with the R Plym, and **Mon 2** at Blacka Brook, may have been designed to retain leats. The leat, **Mon 436**, also seems to relate to the streamworks below on the left bank of the R Plym between Hentor Brook and Spanish Lake (Fig. 5:4), though it is much more substantial than other streamwork leats, which are generally more fragmentary, narrower, shallower and with little bank material. Nevertheless, numerous outflows through the bank lead to parallel ridges below.

It is suggested that the parallel ridges could well be the result of sluicing in trenches. A systematic arrangement of linear trenches would be the most obvious method of introducing water at one end, sluicing a work-face and allowing waste to flow away at the other end. The overburden from an area was removed by wheelbarrow, in the case of cuestaworks, or thrown downhill behind a retaining wall, in the case of retained dump-works. Parallelworks may also originally have had some form of revetment to prevent spoil from falling back into the work area. Thus, as Gerrard suggests, wooden boards may have been provided, which were subsequently removed and re-used. (1986, 215)

This exposed an area of tin ground, which may now be represented as the space between two ridges. A powerful jet of water aimed at this area would break up the tin ground, washing it towards the wall face. It is possible that this process was aided by rough preparation; Hitchins and

Drew observed that the ground in the streamwork noted above had been "previously broken by picks". (1824, 1, 604) Cassiterite would be concentrated in the trench while alluvial silt was washed away.

However, this may only be possible where the ground is loose. In areas of hard ground, it may have been necessary to dig up the tin ground manually and carry it to a "tye" for sorting as described by Pryce. (1778, 133) This could be a neat solution for the hummocky heaps with long channels. The hummocky heaps would be the spoil created in digging up the overburden to reach the tin ground. The digging of regular channels would not be necessary if water was not used for "hushing". The long channels within the mounds would be the tyes. Pryce's tye was only nine feet long (*ibid.*), but the long channels in UPV may be more akin to Agricola's ditch (30 to 36 feet long), which was also used for washing (Fig. 5:12) (1950 ed., 339), or to the sluice "from a hundred to a thousand feet long" used in Californian gold placers. (Simonin 1869, 441) The stone lining still visible in some channels suggests some particular function, rather than simply drainage, for example in Evil Combe and on the right bank of the Upper Plym below its confluence with Crane Lake. (See Figs. 5.11)

The sorting process in the tye could then have added to the hummocky nature of the heaps. Thus in describing the washing process, Pryce warns that "care is requisite to throw off the stent [debris] or rubble from the tye to itself." (1778, 133) Thus detritus separated from cassiterite was periodically removed from the tye and dumped on the waste heap.

Thus two possible explanations for random heaps" have been proposed. It is suggested that they may be a result of trial trenching or "hatching" in unproductive ground or the result of extraction in areas where the ground was too hard for sluicing, though it is still possible that they simply reflect a different method of back-filling or even later dumping. Their presence suggests a distinction between UPV and the areas surveyed on Bodmin Moor.

5.3.4 Eluvial Streamworks

Eluvial placers were defined above as having been deposited on hillslopes in "dry" valleys. (see p. 344) The cassiterite is thus weathered from the lode but not "hydrologically sorted". (Gerrard 1986, 26) Gerrard classified the remains of eluvial streamworks on Bodmin Moor into four types. Type A consists of streamworks with few waste dumps and Types B, C and D all consist of streamworks with parallel dumps, distinguishable by the position and shape of the dumps. Thus, those of Type B are long and parallel to the edge of the streamworks, while the curved banks of Type C and the linear banks of Type D both lie at an acute angle to the edge of the streamwork. (Gerrard 1986, 218)

Gerrard suggested that Type A could have resulted if most of the waste material was light enough to be carried away in suspension, or if the waste was dumped on previously worked areas. (*op. cit.*, 219) He further suggested that Types B, C and D were formed by a similar process to that which produced the parallelworks and retained dump-works in alluvial streamworks, but that the angle and shape of the dumps and, by implication, work-areas, varied, according to the gradient of the slope, to achieve optimum conditions for elutriation. (*op. cit.*, 226-7) Thus locating the work-area directly across the contours on a gentle slope, such as in Type B, maximizes the gradient for elutriation, while locating the work-area at an angle on a steeper slope, such as Types C and D, checks the effects of gradient and may prevent cassiterite as well as waste from being washed away. (*ibid.*) However, Gerrard acknowledges that quantity and velocity of the water supply and the nature of the deposit also contributed to the efficiency of streaming. (*op. cit.*, 227)

Some of these types can be recognized in UPV. Thus, firstly, the long ridges and channels, parallel to the edge of the streamworks in Upper Drizzle Combe (See Fig. 5:14) are a good example of Type B, similar to that in Western Harrowbridge, illustrated by Gerrard. (1986, 222 Fig. 5.13) The walls built across some of the channels are probably late features. The streamworks were presumably supplied by water collected by the dam, **Mon 1127**, which seems to correspond to Type II of Gerrard's classification of dams. (1986, 198) (discussed further below) Construction of the 19th century reservoir, **Mon 1100**, and the Engine Leat, **Mon 1075**, which supplied Eylesbarrow Mine, must have destroyed any leat

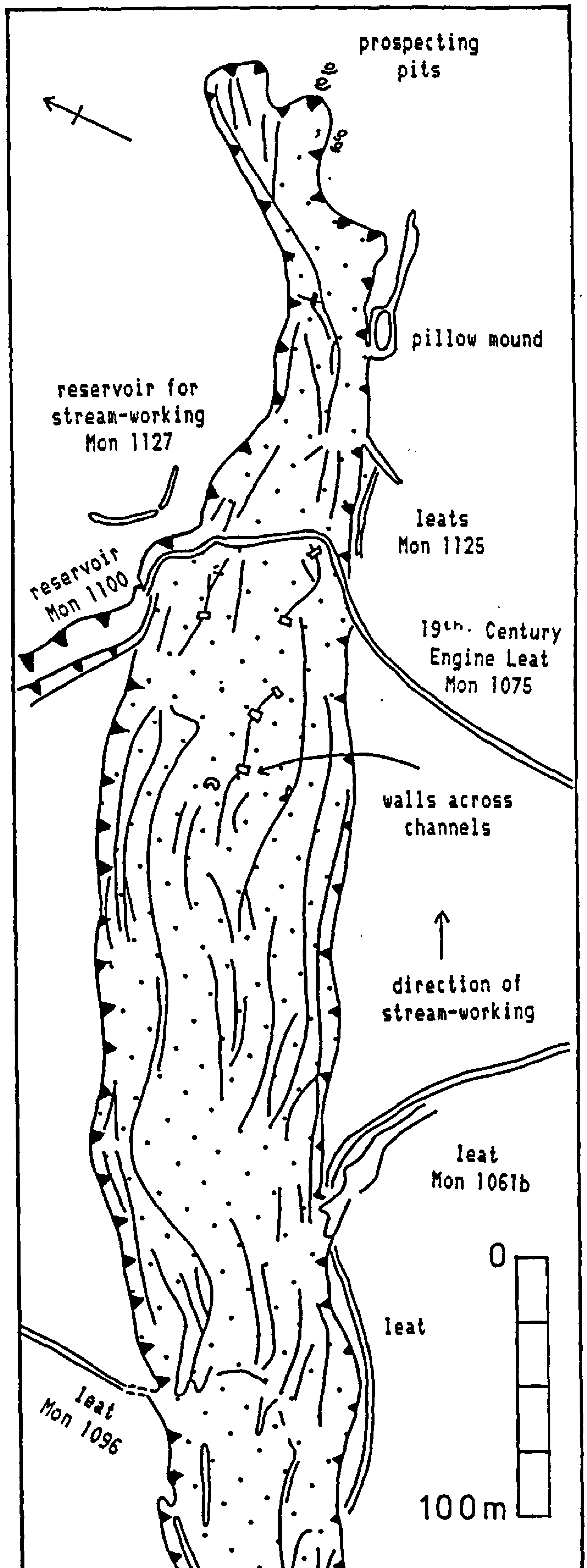


Fig. 5:14 Eluvial streamworks in upper Drizzle Combe

connecting the dam to the streamworks. Additional leats also supplied water to the lower end of the streamwork. On the SE side, **Mon 1061b**, may have collected surface run-off, and its original course seems to have been interrupted by an extension of the tinwork. Surface run-off may also have supplied the leat, **Mon 1096**, on the NW side, though water may also have collected in a reservoir, since destroyed by the 19th century construction of Eylesbarrow Mine

Secondly, the long relatively smooth-floored gullies, **Mon 343** and **347**, which extend northwards from each branch of Legis Lake (Sheet 14) and **Mons 984, 987** and **990**, which extend upslope from streamworks on the R Plym near its confluence with Shavercombe Brook (Sheet 17) may be examples of Type A. The absence of any adjacent workings suggests that the waste was all washed downstream rather than removed and dumped elsewhere. Fragments of banks, **Mons 985, 986, 988** and **989** above the Shavercombe streamworks may have retained leats, capturing water in Shavercombe Brook. However, there is no trace of any water supply at the Legis Lake works and may have been destroyed by agricultural activities. The narrow gully, **Mon X19**, NE of Crane Lake, may also belong to this group. (Sheet 32) It is narrower than the other examples, but is situated amongst other eluvial tinworks.

A third group in UPV may be more akin to the random heaps of alluvial streamworks. Two large irregularly-shaped areas, **Mons X20** and **X21**, NE of Crane Lake, have been turned over in the manner of streaming, though no regular parallel formations have been distinguished. (Sheet 32) These workings are situated amidst a mass of tinworkings, including lodeworks, and the NW end of the roughly T-shaped **Mon X21** may, indeed, be a surface lodework, as it continues the alignment of the adjacent beamwork, **Mon 1192**. A western projection from the S end may also have followed a lode. This demonstrates the difficulty, and perhaps irrelevance, of distinguishing between different types of tinworking as it suggests that tinners proceeded regardless of the nature of the deposit. There is no trace of a water supply associated with either of these workings, but any dam or leat would probably have been destroyed by the tinworking in the area. **Mon X20** is flanked on both sides by ditches but these might be more likely to have been provided for drainage.

Thus, as in the case of alluvial streamworks, the UPV evidence can be shown to fit into Gerrard's classification. Gerrard demonstrates how all these forms may have been produced but it is not clear why the eluvial remains should be different from the alluvial remains. The method, employing a stream of water, seems to have been the same in both cases, differing only in the necessity of providing water to eluvial works by a leat or dam. Furthermore, the importance of gradient in elutriation would have been just as critical in alluvial as in eluvial streamworks. It may be suggested, therefore, that the distinction between alluvial and eluvial streamworks is not particularly significant. No distinction seems to have been made in historical records, unless, as Gerrard suggests, "moorworks" distinguished from "streamworks" by some writers, refers to eluvial streamworks. (Gerrard 1986, 82) Thus it may be suggested that eluvial streamwork Types B, C and D are simply forms of parallelworks.

Conversely, some eluvial forms are also found in UPV in alluvial contexts. For example, long channels and ridges parallel to the edge of the streamwork, similar to Type B, occur in Lower Langcombe Brook (Fig. 5:7) and Lower Shavercombe Brook (Fig.5:9). Furthermore, parallel channels and ridges, some of them curving, are arranged at an angle to the edge of stream-working, similar to Types C and D, in Upper Langcombe Brook. (Fig. 5:8)

It may also be appropriate to consider here the pits dug in eluvial deposits, identified on Bodmin Moor, and termed, by Gerrard "shoad-works", though these are worked by mining rather than streaming methods. (1986, 234-238) These pits were dug to extract separate lumps of ore, known as shoad or shode, but the term may cause some confusion with the practice of "shodeing", in which pits were also dug in search of shode, but for the purposes primarily of prospecting rather than extraction. (described below p.400) Determining the function of the multitude of pits in UPV from surface indications is very difficult and discussed further below. There is nothing in UPV on the scale of the Goonzion shoad-works on Bodmin Moor, which covered about 50 hectares, illustrated by Gerrard. (1986, Fig. 5.22) However, the mass of pits clustered around the eluvial streamworks, **Mons X20** and **X21**, noted above, may be the closest.

5.3.5 Fossicking

There is no evidence of fossicking in UPV, though it is unclear how the archaeological remains would be distinguished. However, there is documentary evidence that it was practised on a small scale elsewhere on Dartmoor, for example Vitifer in the 1920's (Greeves 1986, 24), and extensively in 19th and 20th century Cornwall. (Penhallurick 1986, 153-4) It was already practised in Cornwall in 1733, when operations at "St Piran Arworhal" [Perranaworthal], St Blasy [St. Blaisy] and Tywardreath were described by Tonkin. (1811 ed.,28)

5.4 PROSPECTING

Sometimes the lode may have been encountered in the course of streaming. For example, in UPV, the lode worked in beamworks, **Mons 1186** and **1192** was probably discovered during tin streaming in Crane Lake. The lode may also have been exposed accidentally by natural forces. Torrents of water, which could remove surface soil, strong winds, which could uproot trees, earthquakes or lightening flashes, snow slides and the erosion of sea cliffs and craggy rocks were all recorded by early commentators as possible agents of discovery. (Agricola 1950 ed., 35-36; Pryce 1778, 112) The wearing away of roads and disturbance by horses could also lead to accidental discovery. (Pryce 1778, 112; Hamilton Jenkin 1962, 44)

a) Mostly, however, the lode had to be sought out. A variety of methods may have been used, many of which left no trace in the archaeological record. Contemporary accounts record the discovery of lodes in dreams (Carew 1811 ed., 31; Borlase 1758, 165), by divining (Agricola 1950 ed., 41; Pryce 1778, 114-124), or by observation of differential vegetation growth (Agricola 1950 ed., 37-8; Borlase 1758, 165) The appearance of the will o' the wisp was also recorded as a possible indication of tin and was known variously in the South-West as "the tin lantern" (Hedges 1964, 14), Jack o' Lanthorn (Pryce 1778, 112) and a fiery dragon. (Tonkin 1811 ed., 31)

The latter may explain the enigmatic note scribbled on the Plan of Ellisborough Tin Mine: "A firey dragon was seen to fall near this place". (WDRO WW21) If so, in this case, the will o' the wisp would seem to be accurate; on the plan it is marked near the point where the Engine Leat, Mon 1075, crosses Evil Combe, on a lode named, on the plan, "South Dragon Lode". This seems to equate with the lode worked in beamwork, Mon X10, at the head of Evil Combe. The will o' the wisp is thought to be the result of spontaneous combustion of gases containing phosphines, from the decomposition of vegetable or animal matter and can be seen on marshes on Dartmoor in the present day. (Hedges 1964, 14; Hemery 1983, 55) Its frequent and geographically widespread association with tin deposits suggests that the connection is not simply one in the imagination and Hedges suggests that volatile organometallic compounds may contribute to its appearance. (Hedges 1964, 14)

b) Shodeing, Costeaning, Training

The digging of prospecting pits in search of the lode was recommended by most mining commentators as a more scientific approach. The process was known as "training" (Greeves,1981,124) but usually shodeing (shoading or shoding) after the object of the search, the tin-bearing solifluction deposits or shode (shoad). (Carew 1811 ed., 28-9; Tonkin 1811 ed., 29; Pryce 1778, 124)

The principle was to proceed uphill, digging a series of pits until the lode was encountered. The process may have been triggered by the discovery of an earthfast shode or by observation of favourable signs on the surface. Carew, in 1602, described the Cornish procedure:

> "There they sink a shaft, or pit of five or six foot in length, two or three foot in breadth, and seven or eight foot in depth, to prove whether they may so meet with the load .... if they miss the load in one place they sink a like shaft in another beyond that, commonly farther up towards the hill, and so a third and a fourth, until they light at last upon it." (1811 ed., 29)

An anonymous writer in 1670 provided more detail. He observed that the pits or "essay hatches" were dug down to bedrock, or "the shelf". (also known as "karn") If the first hatch revealed no shode, a second was dug twelve fathoms further on. If this proved barren,

> "we go then as many fathom on each hand at the same height, and sunk there as before, and so ascend proportionably with 3 or more Hatches .... as it were in brest, till we come to the top of the Hill, and if we find none in any of these Hatches, then farewell to that Hill."
> (quoted in Greeves, 1981, 124)

Borlase illustrated such a procedure. (Fig. 5:15) If a tinner finds shode, he sinks a pit just above it at A1. If he finds shode here, he

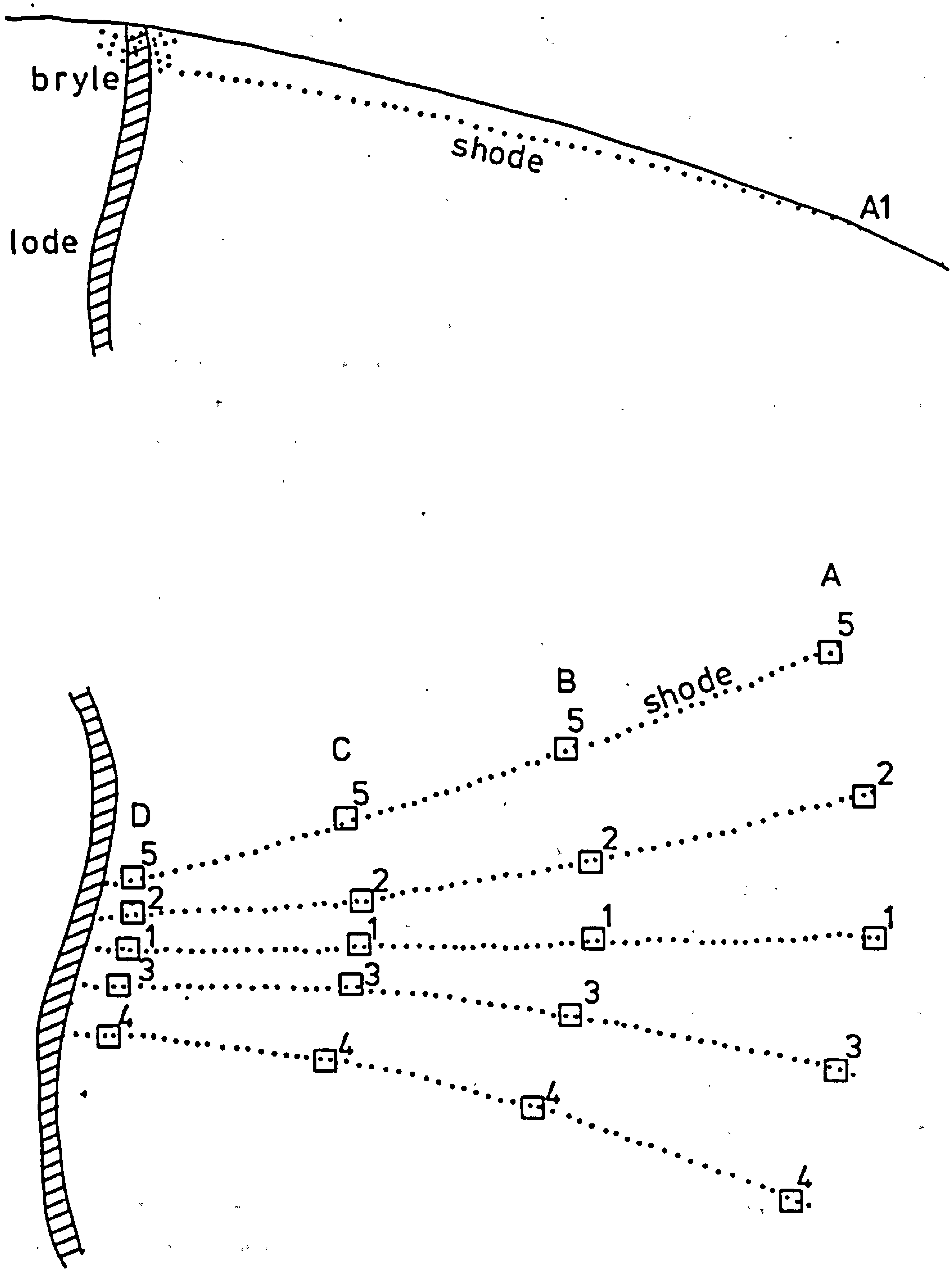


Fig. 5:15 The process of shodeing : section and plan of lode and shode and position of trial pits. (After Borlase 1758 Plate XVII)

ascends the hill, digging pits at B1, C1 and D1. At D1 the tinner should find the bryle (broil), or the weathered capping of the lode and he can dig down to the lode. However, if the tinner fails to find shode in A1, he moves laterally and digs at A2, A3, A4, A5 or beyond until shode is found, whence he proceeds uphill. A development of this practice was "costeaning", named after the Cornish *Cothas-stean*, meaning "fallen or dropt tin". (Borlase 1758, 166) By this method, tunnels or underground "drifts" were dug across the direction of the lode between pits, thereby revealing the nature of the ground without the need for excavation from the surface. (RN Worth 1872, 7)

It was the discovery of shode in a pit that tested the real skill of the prospector. It was accepted that small, rounded shode stones, found singly or in small numbers near the surface, would have travelled some distance from the lode, though this distance could also depend on the degree of slope. (Borlase 1758, 150) However "if the shode .... lies deep. massy and angular, it is a certain sign that the lode is not far off". (Pryce 1778, 127) Once shode was discovered, succeeding pits were sunk at decreasing distances of six, four, two or one fathoms. (Anon 1670 cited in Greeves 1981, 124) A great number of large angular stones lying "as deep as the solid karn" was believed to indicate the bryle (broil). (Pryce 1778, 128; Borlase 1758, 167)

This method of prospecting is of particular interest as it may be expected to leave a mark in the archaeological record. Greeves noted that these essay hatches undoubtedly survive on Dartmoor and suggested likely areas such as Newleycombe and Deancombe valleys and near Nun's Cross. (1981, 125) However, it is difficult to confidently attribute particular pits to the practice of shodeing. Although this method was said to be waning in the 18th century, it is unlikely that the digging of exploratory pits ceased. Tinners unacquainted with the properties of shode, probably still dug pits in their endeavour to find the lode. It should also be noted that essay hatches will only survive where prospecting failed; thus successful pits would probably have been destroyed by subsequent lodework.

Many pits were recorded in UPV, scattered along the valley, though almost exclusively on the North bank. Investigation in the field failed to reveal any significant morphological differences, and no evidence of costeaning was found. Some pits seem to have been concerned primarily with extraction and may, therefore, be eliminated. Lodeback-works, resulting from surface lode-working are easily distinguishable from other groups of pits by their linear arrangement along the orientation of the lode. (see below p.410) Other pits, situated amidst eluvial streamworks at Crane Lake may be "shoadworks", dug for the extraction of shode. (Described above p.398) Some of the pits on northern Ringmoor Down may also be lodeworks, associated with Kit Mine, to the N of UPV near Colleytown, though none of the filled-in shafts, recorded by Hemery (1983, 171), were identified in the field.

An existing streamwork would seem to be a natural starting point in a search for the lode deposits, whether by an experienced shoader or not. A scatter of pits around the head of a streamwork would undoubtedly indicate prospecting, though not necessarily shodeing. However, there is little evidence for pits in such locations in UPV. Two pairs of pits at the head of Drizzle Combe (Fig. 5:14; Sheet 31) are the only clear example, and the cluster of pits situated West of the beamwork, **Mon 1186**, might also be included. A few scattered pits arranged just above and between the upper limits of gullies, **Mons 347** and **343**, may represent attempts to find the lode above Legis Lake (Sheet 14), though no effort seems to have been made to explore further.

Otherwise prospecting pits might be expected to lie in a line or lines, in a roughly N-S or NW-SE alignment, that is, at right angles to the usual orientation of tin lodes in Devon, to maximize the chance of locating the lode. It may be suggested that two single lines of pits, on eastern Ringmoor Down (Sheet 23), another cutting through the wall, **Mon 726** (Sheet 30), and the double line of pits W of Crane Lake (Sheet 32), were all dug for the purposes of prospecting. A search for Borlase's diverging lines of pits may lead dangerously close to "join-the-dot" archaeology. However, it is possible that the pits on the SW spur of Ringmoor Down are a result of shodeing. (see Fig. 5:16) It cannot, of course, be assumed that the pits are contemporary, much less, dug in a particular order. However it is possible that rows A, B and C represent

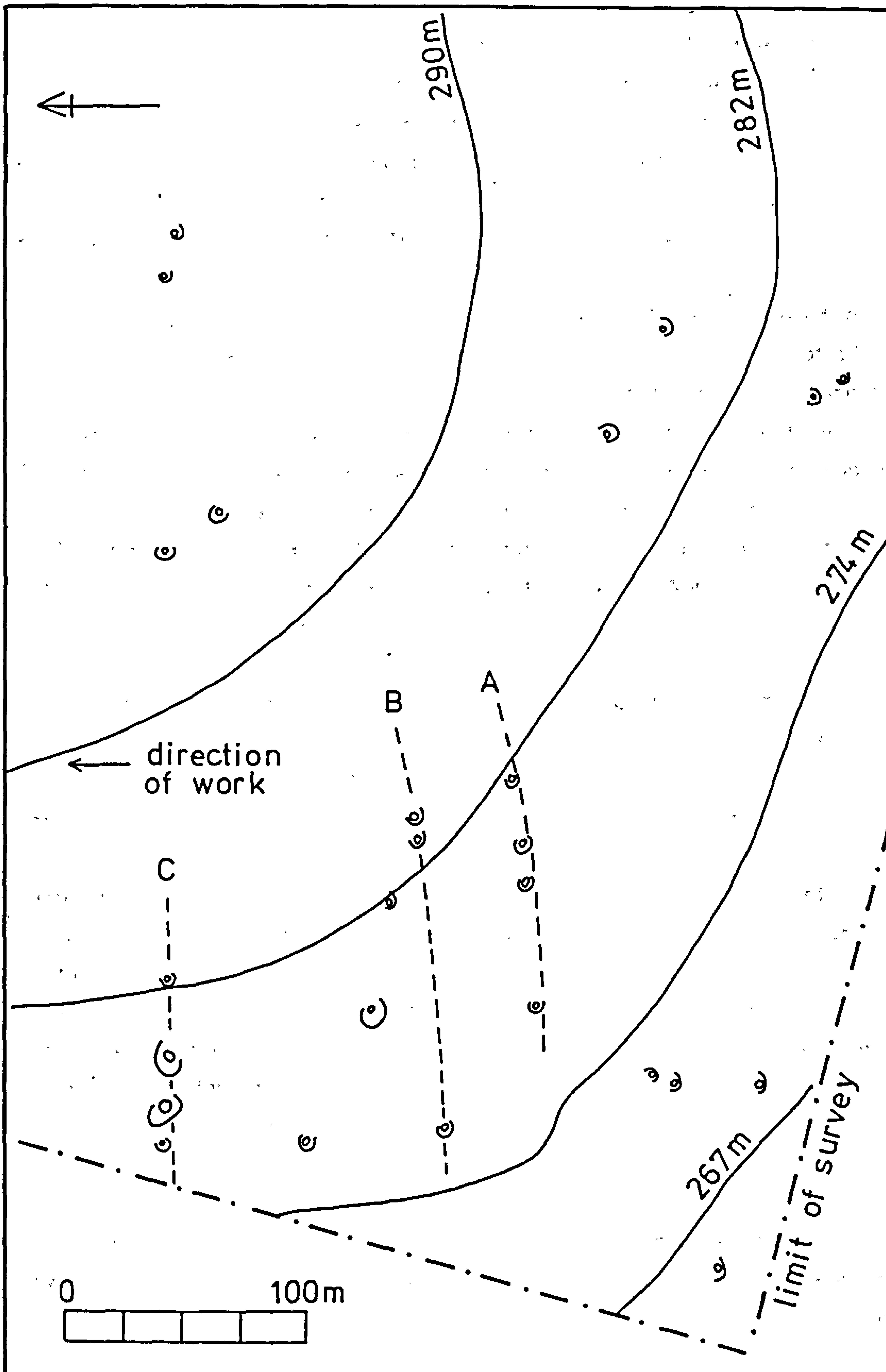


Fig. 5:16 A possible example of shodeing on Ringmoor Down

an early stage of shodeing when pits were dug abreast in order to find the most favourable route to the lode, though the pits are far from the regular 12 fathoms (24m) apart recommended in 1670. A similar situation may explain the three diverging lines of pits proceeding up the North bank of Ringmoor Down (Sheet 21) and the two converging lines of pits running up to the reave, **Mon 271j** from the South (Sheet 22).

Thus it is possible that some of the pits in UPV are a result of prospecting of some kind. It is notable that the vast majority of pits occur on Ringmoor Down. It has already been pointed out that prospecting pits are unlikely to survive if significant lode deposits were found. Therefore, the absence of prospecting pits at Eylesbarrow, apart from a few above streamworks, is not surprising. The limited number of remains of lodeworking on Ringmoor Down, consisting of the shafts associated with Kit Mine, a gully, **Mon 269** and a lodeback-work, **Mon X28**, indicate the limited success of prospecting.

However, the absence of pits on the S bank of the R Plym is more puzzling. Gerrard noted the lack of pits on improved land in St Neot parish, Bodmin Moor, suggesting that they had been backfilled during agricultural work. (1986, 255) Similarly, pits are not found in the enclosed fields of Ditsworthy, Gutter Tor and the Ringmoor Down farmsteads on the N bank. However, on the S bank, pits occur, neither in enclosed fields, nor on the rough grazing of the warrens, and the only surface tinworks on the S bank occur beyond inhabited tenements, ie. E of Shavercombe Brook. Therefore, it may be argued that tinworking was restricted to the valley bottoms by agreements with farming or warrening tenants or landowners, and the preponderance of pits on Ringmoor Down may reflect its use as common land.

c) <u>Drifts</u>

More extensive excavation may also have been used in prospecting. Pryce describes from his own experience, the method of "working a drift", in which a long channel was dug across country from North to South, ie. across the tin lodes.

> "I tried the experiment in an adventure under my management, where I drove all open at grass about 2 feet in the shelf, very much like a level to convey water upon a mill wheel; by so doing I was sure of cutting all Lodes in my way, and did accordingly discover 5 courses, one of which has produced above 180 tons of copper ore." (1778, 130)

Pryce concluded that this method was cheap and certain of success; 100 fathoms could be driven in the surface for 50 shillings. (*ibid.*)

Three gullies in UPV, **Mons 1149, X14** and **X22**, situated S and E of the main shafts of Eylesbarrow Mine, may have been dug for this purpose. They correspond to workings marked on the Plan of Ellisborough Tin Mine, labelled "open drifts". (WDRO VW21) This adoption of Pryce's terminology may support their interpretation as prospecting trenches, though "drift" was also used to describe underground workings. (Pryce 1778, 160) Although these gullies are rather deeper (up to 2m) than Pryce's drifts, the NW-SE orientation, across the direction of the lodes is appropriate for prospecting. Furthermore, the absence of major later workings along them argues against the alternative interpretation that they are openworks on cross-lodes.

d) Hushing

Searching the hills after heavy rain in the hope that torrents might wash away surface soil to reveal tinstone (Pryce 1778, 112), may have led to the deliberate introduction of water for this purpose. The procedure is described:

> "we go to the sides of those Hills most suspected to have any Loads in them, where there may be a conveniency of bringing a little stream of water (the more the better) and cut a Leat, Gurt, or Trench, about 2 foot over, and as deep as the Shelf, in which we turn the water to run 2 or 3 dayes; by which time the water, by washing away the filth from the stones, and the looser parts of the earth, will easily discover, what Shoad is there. If we find any, we have a certainty of a Load, or at least a squatt in the upper parts of the Hill." (Anon 1670, 2098 quoted in Greeves, 1981, 125)

It is possible that some of the many leats on Dartmoor, including UPV, were dug for this purpose. (Greeves 1981, 126)

5.5 OPENWORKS

The term "openwork" is defined as any lodework on the surface. Gerrard (1986, 242) restricts the term to beamworks. However, in the understanding that beamworks, lodeback-works, gullies and ribbonworks are all "open", the use of "openwork" to encompass all forms of surface lodeworking is preferred here. Considerable evidence for openworking is visible in UPV, mostly in the Eylesbarrow area and these remains can be sub-divided on the basis of morphology. The sub-divisions summarized in Table 5:1 can now be examined in detail.

5.5.1 Archaeological evidence of openworks in UPV

a) Beamworks

"Beamwork" is the name given to a steep-sided gully, probably originally with vertical sides though now often V-shaped in section. A beamwork can be up to 250m long, up to 30m wide and about 10m deep (Newman 1987, 226), though depth may reach 30m. (Greeves 1981, 146) At Hexworthy at the end of the 19th century, openworkings were mostly two to three fathoms deep (3.66m - 5.49m) but pits through the floor reached eleven fathoms. (20.13m) (*ibid.*) About 150 beamworks are known in Devon (*op.cit.*, 140), and good examples are found in the Birch Tor and Vitifer area (*op.cit.*, 144; Hamilton Jenkin 1974, 101-2), and in the Meavy Valley, NW of the Plym. (Newman 1987, *passim*) Beamworks also occur in Cornwall, where they are also known as goffens, coffens or coffins.

Although the term "beamwork" seems to have gone out of use in the late 19th century, beamworks survive in place-names into the present, for example, Cater's Beam, NE of Plym Head (SX 633689), though in this case the name is displaced, and Gibby Beam on Western Wella Brook (SX 667677). (Greeves 1981, 140) Many more examples of the "beam" element appear in documentary records of tinworks. The earliest found by Greeves is a 1511 reference to Joys Beme, which provides a *terminus ante quem* for beamworks. (Greeves 1981, 142) In a 1538 document, Richard Strode gives possession of Leggers tinwork to John Strode along with, among other tinworks, Sopersbeme, Somerleybeme, Litelhethbeme, Greenbeme, Waybeme and Yeatbeme. (WDRO 72/990/21, transcribed Greeves 1981, 384)

There have been several suggestions concerning the origin of the term "beamwork". RH Worth suggests that it derived from the rocking beam of a pumping engine. (1926, 360) Greeves suggests that references to German influence in Elizabethan mining (Carew 1811 ed., 42; Hamilton Jenkin 1962, 53) may support a possible derivation from "baum". (Greeves 1981, 141) An association with trees also suggests to Greeves an origin from hornbeam and quickbeam, or locally witch-beam, all names for rowan, which is commonly found in sheltered locations on Dartmoor, including openwork gullies. (*ibid.*) A further possibility is that "beam" originally equated with "lode" or "vein". According to a reference, albeit Cornish, a tinwork called "the myne of the cleker", in 1474 had to be dug twelve fathoms deep before "the proper beame" was reached. (Salzman 1923, 72)

Another term of relevance to UPV, which may be equivalent to "beam" and "beamwork" is Girt, Gert or Gurt. The large openwork gully, **Mon 1192**, is known as Hooper's Gert. (Hemery 1983, 194; Robins 1984, 134) Other examples include T Girt on Western Wella Brook (SX 663678), Fox Tor Gert, on a tributary of R Swincombe, NNE of Plym Head (SX 627696) and Greenwell Gert, on a tributary of the R Meavy (SX 540657). (Greeves 1981, 144) Pryce seems to be referring to a leat when he describes a Gurt as "a channel to carry off water from one place to another for dressing of Copper Ore, Tin or the like". (1778, 322) However, RH Worth suggests that girt or gert referred to a steep-sided valley or a mine gully and derived from the Anglo-Saxon *grut*, meaning a gulf or abyss. (1926, 362-3)

i) **Mons 1186** and **1192** in Crane Lake are the most impressive examples in UPV. **Mon 1192** is V-shaped in section, 200m long, 25m wide and 15-20m deep. **Mon 1186** is 80m long, 9m wide and 15m deep, and has almost vertical sides. (See Plate 5:1) At the W end of the latter, the beginning of a drift is visible on the S side, though it is not clear how far this extends underground. The gullies are not marked on the 19th century Plan of Ellisborough Tin Mine, unlike "old streamworks", but they probably correspond with the Crane Hill Lode, which crosses Crane Lake at structure/dressing house, **Mon 1188**. (WDRO WW21)

The absence of clear documentation for either of these beamworks precludes accurate dating. One of them might be the tinwork entitled Cranelakehed, part of which changed hands in 1640 (WDRO 72/990) However, such a name is more likely to apply to a streamwork at the head of Crane Lake. Crane Lake Mine is documented in 1792 but is also described as a streamwork. (Cook *et al*,1974,164)

Plate 5:1

Plate 5:1 Beamwork, **Mon 1186**

ii) **Mons X10a, b** and **c** are three parallel gullies, V-shaped in section, which have a similar appearance to **Mon 1186**. They project westwards from the head of Evil Combe. These gullies are not marked on the Plan of Ellisborough Tin Mine, but they probably correspond to the North and South Dragon Lodes, so that a lodework of some kind might be expected. (WDRO WW21) One or all presumably equate with Evill Beame or Gret Hevell Beame, part of which changed hands in 1563. (DRO DD 4349) (See App. D)

iii) Documentary evidence indicates the position of another beamwork. Allhalloubeame, which was pitched in 1601, was said to be "upon the very Rudge [?crest] of the hill above Hentor hill Shabbercombe and Colemore Rudge". (WDRO 72/1034) (See App. D) This may be outside the watershed boundary of UPV as it is described as "streaming towards Yealm". (*ibid.*) However, no archaeological remains have been identified around the watershed. Aerial photographs reveal only extensive peat cuttings. (RS CPE/UK/2494 frames 4055-7, 3126-8)

b) Lodeback-works

More common in UPV are the pits and waste heaps arranged in linear series on E-W, ENE-WSW and NE-SW alignments. These have been classified as lodeback-works, following Gerrard's terminology. (Austin *et al* 1989, 50) Presumably the pits were excavated into the surface of the lode but were not developed into deep beamwork gullies, while waste was dumped on the spot rather than being washed away. A Dartmoor-wide survey would ascertain how common they are and if, as in UPV, they outnumber true beamworks. Five examples were recorded by Gerrard in Cornwall, three in St Neot parish, Bodmin and others at Carn Brae and Kerrowe. In UPV, ten examples are recorded. **Mons 1124, 1160, 1161** and **1167**, all in the Eylesbarrow area, consist of linear trenches and waste ridges as well as pits. **Mon X12**, also at Eylesbarrow, consists of a single line of pits. **Mon X11a** and **b** seems to be a westward extension of the beamworks at Evil Combe, **Mon X10**. **Mons X15** and **X16**, situated E of Crane Lake, are particularly long spreads of pits, each extending to over 200m. **Mon 1203** is the only surface lodework on the S bank of the Plym, situated near Plym Head, and, finally, **Mon X28** is mostly a single line of pits on the western slope of Ringmoor Down. None of these lodeback-works have been linked with any documentary references, though it is possible that some correspond to 16th and 17th century references to Eylesbarrow. For example, the 1599 and 1660 references to Easter Yealesborough and Easter Yelsbour' (DRO DD 1357; DD 4350), could apply to lodeback-works, **Mons 1160** or **1167**, while a 1660 reference to Yelsbour', Wester (*ibid.*), could apply to lodeback-work, **Mon 1124**. However, these could equally refer to shafts.

While lodeback-works and beamworks account for most of the surviving openworks in UPV, a few remains cannot be fitted into either category.

c) Gullies

Three long gullies, **Mons 269, 327** and **1123**, have been recorded in UPV, which are similar in plan to beamworks but being relatively shallow lack the monumental scale of beamworks, such as **Mons 1186** and **1192**. These have no accompanying spoil heaps but pits have been dug through the floor of each and all slope upwards to near surface level at one end. These gullies may equate with the Type I lodeback-works, identified by Gerrard at Goonzion and Carn Brae, in contrast to Type II, which correspond to the UPV lodeback-works. (Gerrard 1986, 239) However, the possibly different method of working (discussed below) may suggest that these are best kept in a separate category.

d) Parallel Gullies and Ridges, **Mon X13**

In the area NE of the account house, **Mon 1134**, is a group of remains akin to some of the lodeback-works and gullies, yet quite different from either. Two curvilinear gullies are separated and flanked by long waste ridges. These ridges distinguish the group from the gullies, **Mons 269, 327** and **1123** and suggest a clear similarity to lodeback-works. Yet the group is distinguished from lodeback-works by the continuous nature of the gullies, instead of interrupted pits and trenches. **Mon 1167**, which contains one long gully parallel with a line of pits and two ridges may be the closest analogy. At the SW end, the gullies and ridges run up to, and were probably destroyed by, the buildings and enclosures of Eylesbarrow Mine, **Mons 1134 - 1137**. They were possibly truncated at the NE end by a track and later tin working. These gullies and ridges are not marked on 19th century plans (WDRO WW20a and WW21), but they may correspond to the "considerable" workings "by the old men or ancients" on " the middle or north lodes of the sett", described in 1847. (MJ 5.6.1847)

e) Ribbonworks

Two adjacent groups of trenches, **Mons X17** and **X18**, on the N side of Leedon Hill form another category, termed here "ribbonworks". (Sheet 29) Each group comprises almost parallel, narrow, disconnected trenches, from 14m to 55m in length, with minimal spoil.

f) The distinction between beamworks and lodeback-works

Although, as noted above (see p349), variations in archaeological remains may not necessarily reflect significant differences in working practices, some explanation should be sought for these variations. The beamworks, **Mons 1186, 1192** and **X10**, correspond most closely to the model of a surface excavation worked to a maximum depth of 20m to 30m, along the lode. The shallower gullies, **Mons 269, 327** and **1123** and the parallel gullies and ridges, **Mon X13**, may also conform to this pattern. The lodeback-works are also clearly aligned on a lode, and excavated to some depth, but are intermittent. It is possible that the pits and trenches rather than long gullies were adopted as an economical solution to working a discontinuous lode. Thus Pryce may well be referring to lodeback-works when he explains that:

> "If the Lode was bunchy, or richer in one part than another, they only laid open and sunk upon it perhaps in small pitches not more in length than one of the stopes or shammels." (1778, 141)

5.5.2 Equipment

Equipment used in openworks was probably similar to that used in shafts. All lodework tools are therefore described together below. (see p.435) However it is appropriate to note here equipment found in old openworks. A light iron pick, still with its wooden handle was found at Redlake, during 20th century china clay excavations. (RH Worth 1914, 288) Fire-setting, described below (p.436) may also have been used and Gerrard suggests that the main purpose of the reservoirs may have been to provide a coolant for fire-setting. (1986, 245; Austin, Gerrard and Greeves 1989, 66) Furthermore, Hemery suggests that the very deep gully S of Newleycombe Lake (SX 582696) (Newman's No. 14) was excavated with gunpowder. (Hemery 1983, 140)

No contemporary descriptions have been found of shoring in openworks, but timber supports must have been used. For example, an oak strut was found, as well as the iron pick, at Redlake and was described by RH Worth:

> "the piece was half round, about 6 1/4 inches across, split from a tree of that diameter; it was between 6 and 7 foot in length, and at each end a notch 3½ inches wide by 1½ inches deep had been cut, evidently as housings for vertical timbers. The notches appear to have been cut out with hatchet and chisel; no saw has anywhere been used on the timber ..." (1914, 288)

This suggests that the sides of gullies were at least occasionally supported by vertical posts with cross pieces. Another oak timber, 4ft (1.22m) long, was found 12 to 13 fathoms (21.96m - 23.79m) deep at Great Week Mine, near Chagford in 1887. (Greeves 1981, 146)

5.5.3 Methods of working

a) Beamworks

Pryce provides the most detailed account of openworking techniques adopted in the 15th century, though not prevalent at the time of his writing in 1778. (1778, 141-2) His description of the Cornish "coffin" may also explain the Dartmoor beamwork. According to Pryce, a lode near the surface was excavated by the system of shammelling, in which digging descended in steps, and excavated material was thrown up or "shammelled" from step to step. The height of each step was thus dictated by the distance, which "a man can conveniently throw up the Tin-stuff with a shovel". (Pryce 1778, 141) These steps or shammels were usually about 6ft (1.83m) high and work proceeded as follows:

> "They sink a pit one fathom in depth and two or three fathoms in length, to the east and to the west, of the middle part of the lode discovered; then they squared out another such piece of the lode for one or two fathoms in length as before, at the same time others were still sinking the first or deepest ground sunk, in like manner; they next went on and opened another piece of ground each way from the top as before, while others again were still sinking in the last and in the deepest part likewise." (Pryce 1778, 141)

During the operations the openwork would thus resemble a series of steps similar to those illustrated in Fig. 5:17 in an openwork copper mine in Rammelsburg, Harz Mts. The series of five platforms at the bottom of Hobb's Hill beamwork may also have been produced in this way, though quarrying dated to the 1870's. (Gerrard 1986, 246)

Raising ore to the surface while removing the topmost steps must have required some modification. Pryce describes the construction of timber shammels or platforms at appropriate intervals where very hard country rock precluded standard shammelling. (*op.cit.*, 142) Such timber platforms could have been erected to enable the raising of ore from the top steps.

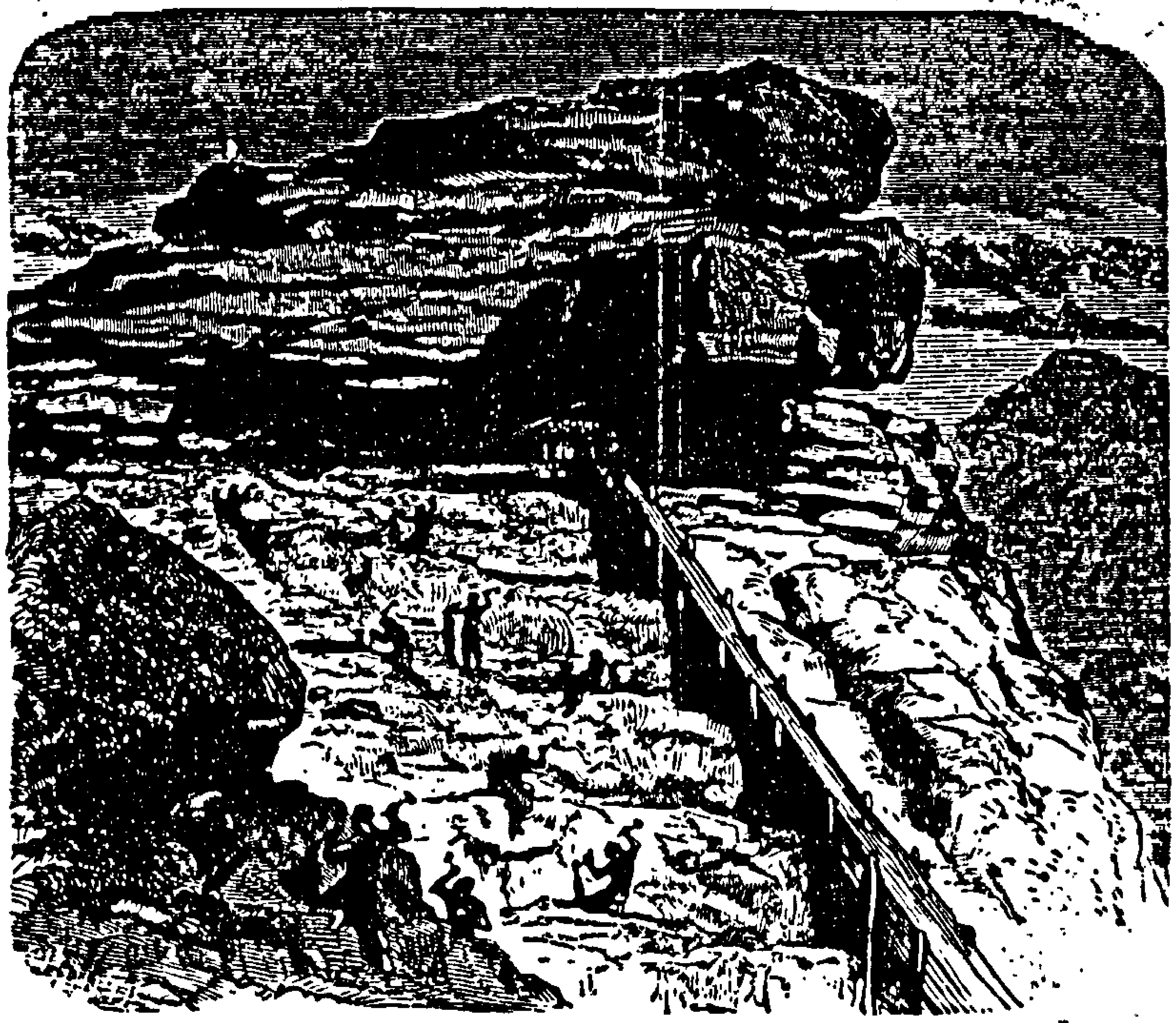


Fig. 5:17 Openworkings at Rammelsberg. Harz Mountains. (from Simonin 1869 fig 114)

However, no evidence of this method survives in UPV. Excavation in stages seems the most methodical approach and this may have been adopted. However, according to Pryce, it was done in order to raise the ore "till it came to grass". (1778, 141) This may have been essential in an openwork on relatively level ground, such as **Mon 1186**, but it is hardly necessary in an openwork on a slope and particularly in one, opening out at the lower end into a river valley, such as **Mons 1192** and **X10a, b** and **c**. In Fig. 5:18, depicting direct stoping underground, the excavated material is shovelled down from step to step to the adit before removal in a wagon. A similar procedure may have operated in openworks, such as the UPV beamworks, though ore may have been sorted on the spot before removal. Pryce does not record the procedure for preparing ore from shammels and possibly all excavated material was carried to a dressing floor and sorted in a similar way to ore from shafts. (see below) However, greater economy of effort could be achieved by roughly sorting excavated material *in situ* in a stream of water, similar to the method in streamworks.

Gerrard maintains that, for example, at Colliford, apart from the bryle above, the lode would have been too hard to have been sorted simply in a stream of water. (Gerrard 1986, 245; Austin *et al* 1989, 66) However it still seems quite feasible that, as Greeves suggests, water could have been used for "sluicing away waste material". (Austin *et al* 1989, 66) The use of sluicing in lodeworks may explain the use of the term "streaming" in connection with lodeworks in contemporary documents. Thus the description of Allhalloubeame on the SE border of UPV, in 1625, as "streaming towards Yealm" may indicate that the detritus from this beamwork was washed into the R Yealm. (WDRO 72/1034)

Further, a 19th century description implies that water was used to "turn over" lodeworks as well as streamworks:

> "On every hill as high as water could be diverted, the ground has been turned over by the help of these artificial torrents, the veins or lodes taken away to a certain depth; and the stream works .... were made productive by washing away the alluvial matter." (Risdon 1811 ed., xiii)

It was observed above (see p.393) that streamers washed some detritus downstream but probably dumped the overburden on the site. Lack of an appreciable amount of spoil at beamworks might suggest that all debris was washed downstream, though excavation of part of an openwork at West Colliford, Bodmin Moor, revealed that a large amount of spoil had been backfilled into exhausted workings and thus a greater amount of spoil may be dumped in beamworks than is apparent on the surface. (Austin *et al* 1989, 64) However, the increasing number of complaints about damage to estuaries and harbours in the 16th and 17th centuries may reflect the amount of debris washed from the greater number of openworks. The 1531 Act of Parliament designed to protect Plymouth and other harbours has already been noted (see p.359) and the 1532 Great Court stipulated that tinners should dump rubble in "old Hatches, Tipittes, miry Places, or other convenient Places" away from the rivers. (Radford 1930, 239) However, this was probably frequently disregarded because of the extra effort required, and complaints continue into the 17th century. (see above p.359)

Dams

Four dams are recorded in UPV, of which three, **Mons** 1156, 1157 and 1197, seem to be related to openworks. The low earthen dams are crescentic in plan with an opening near the middle, sometimes stone-lined, for a sluice-gate. Each would have retained an ovoid reservoir, though this can only be detected at **Mons** 1157 and 1197, and each probably collected surface run-off water. Of 15 openwork reservoirs recorded by Newman in the Meavy Valley, five were wholly, and one partially, fed by leats. (1987, 232-3) However, the UPV openwork reservoirs are all above 427m and too far up Eylesbarrow Hill to receive any water from the Plym, which is a very slight stream above an altitude of 434m.

It might also be questioned how much surface water could be collected in a dam so near the summit of a hill, as **Mon** 1157. In the Meavy Valley, long ditches were recorded running into two reservoirs serving two different openworks at Newleycombe Head. (Newman 1987, 232-3) These "collecting gutters" would have channelled surface water from a wide area into the reservoirs. Reservoir J had four gutters, one of which was over 100m long. (*ibid.*) These channels were also recorded by French and Linehan (1963, 178), but have not been traced at any of the UPV reservoirs.

Gerrard (1986, 198-201) found six different types of dams in St Neot parish, Bodmin Moor, which varied, he suggested, according to the velocity of water required. Thus, on a gentle slope, greater velocity of water would be achieved in a dam consisting of two banks at an acute angle. (*op. cit.*, 200) Two UPV dams, **Mons** 1156 and 1197, are V-shaped and, therefore, correspond to Gerrard's Type IV, designed to increase velocity, though there does not seem to be a great difference in the gradient of the slope between these two examples and the gently-curved concave dams, **Mons** 1157 and 1127 (Gerrard's Type II).

Only one water supply network can be firmly associated with a particular openwork in UPV. Reservoir, **Mon** 1197, is situated uphill to the N of the NE end of beamwork, **Mon** 1192. Two leats emerge from the sluice-gate. The longer W one, **Mon** 1191, runs parallel with the beamwork towards the scarp slope of streamworks in Crane Lake. It is possible that this reservoir and leat originally served the streamworks and were later adapted to the beamwork. The distance of the reservoir from the SW end of the beamwork (presumably the earliest phase) is unusual (150m) In Newman's survey of 15 openwork reservoirs in the Meavy valley, 13 were situated immediately above an openwork and, similarly, two dams were found immediately above the openwork at West Colliford. (Newman 1987; Gerrard 1986, 245) This implies that a large head of water was not essential, though conversely, the arrangement at Hooper's Gert suggests that it was not a handicap either. When work progressed northeastwards along the lode, water was required at the workface. Thus the branch leat, 60m from the sluice was provided. When work progressed still further, a second leat was dug to serve the NE end. The three branch channels of this leat may correspond to the three final stages of operations.

The proximity of reservoir, **Mon 1127** to Upper Drizzle Combe suggests that it is associated with the eluvial streamworks. The distance of reservoirs, **Mons 1156** and **1157** from streamworks suggests that these must relate to openworking though it is difficult to pinpoint the relevant tinworks. Although most of the Meavy reservoirs were located close to their openwork, two reservoirs were over 200m from a tinwork. (Newman 1987, 228-233) Similarly, **Mon 1197**, would have been 150m away from the earliest operations in beamwork, **Mon 1192**. Thus it is not sufficient to restrict the search to the immediate vicinity. Difficulty is increased by the considerable damage inflicted by 19th century mining. In the absence in the vicinity of large-scale operations, such as beamworks, these reservoirs, if intended for lode mining, must have served smaller openworks. French and Linehan observed that water supplies were not just associated with large gullies. Thus a small openwork, 20 to 30yds long, S of Kingshead Tor, Widecombe-in-the-Moor was supplied by a leat fed from a spring. (1963, 178)

A leat emerging from the stone-lined sluice at **Mon 1157**, continues for 65m, indicating that this reservoir was intended for use some distance away. It is thereafter destroyed by a track and later tin working, but its original destination may have been the parallel gullies and ridges, **Mon X13**. Although waste has been dumped methodically in ridges, water may have been used to sort excavated ore in the bottom of the gullies. Alternatively, the leat may originally have joined drain, **Mon 1139**, which flows towards the buildings and enclosures around Eylesbarrow Account House, **Mon 1134**; it is indeed possible that it supplied a domestic water supply to the house.

A series of shafts and pits obliterates any trace of a leat from reservoir, **Mon 1156**. The drain, **Mon 1155**, runs straight past the sluice-gate and is therefore unlikely to be associated. However, the reservoir may have been connected with prospecting gullies, **Mons 1149**, **X14** and **X22**.

Effort must have been required to dispose of water-borne debris to protect other tinworks. Waste could have been dumped in old pits in compliance with the 1532 Statute, but water still required an outlet. For example the parallel gullies and ridges, **Mon X13** are situated some distance from a river. For comparison, it is interesting to note that, in the Meavy Valley, all the water-worked openworks are relatively close to an outlet, while the only openwork (No. 21, SX 589710), which is a considerable distance from a river, has no associated water supply. (Newman 1987, 228-231)

An alternative explanation for reservoirs, **Mons 1156** and **1157**, might be that they supplied water-powered pumps at the top of shafts. The leat from reservoir, **Mon 1157**, heads towards shaft, **Mon 1150**, while shaft **Mon 1154** is within range of reservoir, **Mon 1156**. The use of these dams to feed water-wheels is not unknown elsewhere. Newman sugests that two linear dams (SX 599699) S of Newleycombe Lake supplied a wheel pit of the 19th century mine Wheal Chance. (1987, 233) There is no trace of any wheel pits in this area, but water-powered "flop-jack" or beam engines could have been in use. (See below p.442)

It may be assumed that beamworks, **Mons 1186** and **X10**, were water-washed, though the supply is now undetectable. A leat could have brought water to **Mon 1186** fairly easily from further up Crane Lake. The N branch of Evil Combe is marshy but might have provided enough water for a leat to Evill Beame, **Mon X10**.

b) Lodeback-works

A long curving drain, **Mon 1164**, runs round the E slope of Eylesbarrow Hill for 320m to lodeback-work, **Mon 1167**. This channel is similar to the collecting gutters recorded in the Meavy Valley and presumably captured all the surface run-off on the E side of Eylesbarrow Hill. This may have filled a reservoir, later destroyed by a S extension of the lodeback-work or it may have provided sufficient water on its own.

No other water supplies are recorded in association with lodeback-works. Water would hardly have any benefit in the small pits and trenches, and ore may have been raised to the surface for sorting. Pryce suggested a method of raising the ore from such short "pitches":

> "The shortness of such a piece of Lode would not admit of their sinking stope after stope; it was then natural and easy for them, to square out a shammel on one side or wall of their Lode, and so to make a landing place for their Tin-stuff cast after cast." (1778, 141)

c) Gullies, Parallel Gullies and Ridges and Ribbonworks

Excavated material from the remaining types of openworks may have been similarly raised to the surface, though these are mostly relatively shallow workings. Waste was obviously dumped at **Mon X13**, but the only explanation for lack of waste at gullies and ribbonworks, without clear evidence of water supply, for example **Mons 269, 327, 1123, X17** and **X18** is that the material was carried away for treatment.

5.6 UNDERGROUND MINING

Depletion of surface deposits necessitated recourse to underground mining, though it may be misleading to over-emphasize its contribution. While underground mining has made a significant impact on the archaeology of Dartmoor, it may only have accounted for 20% of all the tin obtained. (Broughton 1968, 34) The earliest recorded shaft and adit mining in the West Country was at the royal argentiferous lead mines in the Bere Alston peninsula of W Devon. Thus in 1297, the method of draining pits by adit or "avidods" was introduced to the lead mines; payments averaging £12 10s to "William Pepercorn and his partners" and to six other gangs "for making avidods" are recorded in the accounts for that year. (Salzman 1923, 53-55)

However, it is usually assumed that shafts and adits were not introduced to the tin industry until at least the 15th century. (Pryce 1778, 141) Hoskins suggested that the increase in Devon output in *c.* 1500 and the dramatic rise in Cornish production in 1495-6 may coincide with the introduction of shaft mining. (1972, 133) They may have been known before this; the employment of 100 tinners for digging avidods in the lead mines has already been noted. (see above p 351) However, shafts and adits do not appear in the documentary record of the tin industry until the 16th century.

Carew, writing in 1602 but probably relating practices current in late 16th century Cornwall, describes the digging of a shaft and gallery or horizontal drift "so far as the air will yield them breathing" and:

> "the bringing of an adit, or audit, when they begin to trench without, and carry the same through the ground to the tinwork somewhat deeper than the water doth lie, thereby to give it passage way." (1811 ed., 37-8)

Hooker's account of *c.* 1598-9 suggests that the Devon tinners were mostly engaged in underground mining:

> "His lyffe most commonly is in pyttes and caves under the grounde of a greate depth and in greate daunger because the earthe above his hedd is in sundry places crossed and posted over w[i]th tymber, to keepe the same from fallinge." (1915 ed., 342)

The early shafts may still have been relatively shallow. Harris suggests that true shaft mining did not commence on Dartmoor until the 18th century. (1968, 26)

5.6.1 Archaeological Evidence of Underground Mining in UPV

Some of the underground mining may date to an earlier period but most of the remains were probably part of Eylesbarrow Mine, which operated between 1814 and 1852. Filled-in shafts on the northern slope of Ringmoor Down may, as Hemery suggests, have been associated with Kit Mine, to the N of UPV near Colleytown. (Hemery 1983, 171) However, individual shafts were not distinguished in the field from the numerous pits on this slope.

The interpretation of the archaeological remains of shafts and adits is particularly difficult as the most important evidence is underground.

However, some idea of the development of Eylesbarrow Mine can be built up when the UPV survey data is supplemented by documentary evidence, which exists in the form of the contemporary plans and section, noted above, and reports in the Mining Journal.

Limitations are apparent in both these sources of documentary evidence. For example, the pre-1847 section records four adits, intersected by a series of shafts, but unfortunately the stylized two-dimensional drawing does not give a clear idea how the adits relate to the various shafts; some of the shafts may have been unconnected to the adits, through which they are drawn. (WDRO WW20b) Other documentary evidence suggests that the adits were never all in use at the same time and certainly not arranged one above another along the same route.

Further ambiguities lurk in terminology. References to a "new" shaft are not necessarily restricted to a single shaft; a shaft is obviously only "new" until work begins on the next one. Similarly the terms, "shallow" and "deep" applied to adits may simply refer to the relation between two adits contemporaneously in use, rather than define two particular adits throughout the history of the mine. However, by correlation of field and all documentary evidence, the layout of the mine can be reconstructed.

a) Adits

i) Shallow Adit.

Shallow Adit, marked on the pre-1847 section seems to correspond with the shallow adit noted on both contemporary plans, and **Mon 1099** in the field. (WDRO WW20b, WW21, WW20a) The mouth of the Shallow Adit is a low, partially-blocked opening, **Mon 1099a**, within a mound between the Sheepstor - Nun's Cross track and field wall, **Mon 1102a**. A small stream of water still issuing from it, once supplemented the reservoir, **Mon 1100**, but a later channel, **Mon 1099b**, cut through the leat, has diverted it to the S and probably eventually into Upper Drizzlecombe.

Accepting the limitations of the pre-1847 section, it might be reasonable to assume that Hawks Shaft is associated with the Shallow Adit. According to the section this shaft stops at the adit and on the ground, Hawks Shaft, **Mon 1132** lies 157.5m from the adit mouth. Another unidentified shaft, **Mon 1131**, 100m from the adit mouth may also have been connected with the shallow adit. It is not clear how far east the Shallow Adit continued. The New Footway Shaft, **Mon 1150**, reached it at a depth of 9 fathoms and it is possible that it also reached Henry's Engine Shaft, **Mon 1153**. (VDRO VW21) The report in December 1847, that "we have holed Henry's [Engine] Shaft to the shallow adit, which is 15 fathoms from surface" is difficult to interpret. (MJ 11.12.1847) This can hardly be Two Brothers' Adit, which is 31 fathoms from surface, but it is deeper than the 9 fathoms recorded for Shallow Adit at New Footway Shaft. Possibly the slightly greater elevation of Henry's Engine Shaft, accounts for the extra 10.98m.

ii) Two Brothers Adit.

Reports in the Mining Journal, prior to and during the 1847 revival, refer to two adits excavated by the previous adventurers. The "shallow" one was "driven east on the main lode upwards of 600 fathoms", 31 fathoms below the surface. (MJ 6.3.1847) A deeper adit level was dug at a depth of 29 fathoms " under the shallow adit level" and thus 60 fathoms below the surface. (*ibid.*) However, it is clear from subsequent accounts in the Mining Journal, that these do not correspond to Shallow Adit and Deep Adit, marked on the pre-1847 section. Reports of progress refer to "cleaning and repairing the two brothers' adit" (MJ 15.5.1847; 12.6.1847; 3.7.1847), until "our adit is all but clear from the tail to near Pryse Deacon's Shaft which is upwards of 600 fathoms" (MJ 10.7.1847) Thus the 600 fathom - long "shallow adit", described in March 1847, must be Two Brothers' Adit. The description by visitors, in June and July 1847, of their inspections of the "shallow adit" indicate that the Two Brothers' Adit was the shallowest adit in use at the time, suggesting that Shallow Adit was obsolete. (MJ 5.6.1847; 21.7.1847) The draughtsman of the pre-1847 section must simply have wished to record its existence; the mouth was presumably even more visible then, than it is today, and may still have been used for access.

The route and length of Two Brothers' Adit can be traced using field and documentary evidence. The location of its exit is established by the reference to the proposal to erect a 50ft wheel near "the tail of Two

Brothers' Adit". (MJ 3.7.1847) The adit mouth, clearly visible near the pit for the 50ft wheel, **Mon 1111**, is 833m as the crow flies from Pryce Deacon's shaft, **Mon 1154**, rather short of 600 fathoms (1098m). However, the route taken by Capt. Gregory on his inspection of the adit on 5th July 1847, which passed Henry's (**Mon 1109**), Whimb (**Mon 1104**), New Engine (either **Mon 1140** or **X23**), Old Engine (**Mon 1148**) Shafts and nearly reached Henry's Engine Shaft (**Mon 1153**) en route to Pryce Deacon's Shaft (**Mon 1154**), accounts for a distance of 1060m. (MJ 10.7.1847) (see documentary extract 6) Minor alterations underground could easily require another 40m.

The depth of the adit is also reasonably consistent throughout the documentary evidence. According to notation on the pre-1847 section, Two Brothers' Adit lies 17 fathoms below Shallow Adit. (WDRO WW20b) A note on the contemporary plans indicates that New Footway Shaft reached Shallow Adit at a depth from the surface of 9 fathoms. (WDRO WW21; WW20a) Accepting that distances from the surface obviously varied according to location on the hillside, a total depth of 26 fathoms for Two Brothers' Adit accords well with the 31 fathoms described in the Mining Journal. (MJ 6.3.1847)

The mouth of Two Brothers' Adit, **Mon 1112a**, consists of an opening, 1.50m to 2m high, revetted with dry-stone masonry, from which a considerable flow of water issues. The interior of the tunnel, in which a man could stand upright, is illustrated in Atkinson's Dartmoor Mines. (1977, 19) This adit may have been first dug in the early 1840's. It does not appear on the post-1836 plan and, therefore, must not have been in existence until sometime after 1836. (WDRO WW20a) However, a 600 fathom - length had been completed before the closure of the mine in 1844 (MJ 6.3.1847), and a later report indicates that this was achieved at great expense. (MJ 10.4.1847) An advertisement for Devon Consols Tin Mines in 1846, which most probably refers to Eylesbarrow, notes that "the adit level" [probably Two Brothers'] was excavated "at a cost of upwards of £2000". (MJ 18.4.1846) After the 1847 re-opening, the adit had to be cleared of debris and re-timbered for use, though it was still possible to walk through it for most of its length. (MJ 15.5.1847) and by October 1847, it was said to be completely repaired. (MJ 9.10.1847)

iii) Deacon's Adit

As noted above, the reports on the facilities at Eylesbarrow, prior to the 1847 re-opening, referred to a deeper adit level, 29 fathoms under the "shallow" [ie. Two Brothers'] adit, and thus 60 fathoms below the surface. (MJ 6.3.1847) This adit commenced "about 60 fathoms farther to the west" and was "driven east on the lode about 120 fathoms". The 1847 adventurers also referred to a "splendid course of tin gone down in the bottom of the deep adit", W of Henry's Shaft, **Mon 1109**. (MJ 12.6.1847) This surely corresponds to the "Good tin gone down", marked on the pre-1847 section at the foot of Sutton and Henry's Shafts on Deacon's Adit. (WDRO WW20b) Furthermore, although the scale of the section may not be very accurate, Deacon's Adit is drawn 20 fathoms below Two Brothers' Adit, which accords reasonably well with the distance of 29 fathoms between the "shallow" and "deeper" adits, noted in the Mining Journal. Thus it is almost certain that the 60 fathom adit equates with Deacon's Adit.

The mouth of Deacon's Adit is presumably 60 fathoms (109.8m) W of the mouth of Two Brothers' Adit, **Mon 1112a**, and, therefore, at approximately SX 5919 6822, but was not located between 1982 and 1986, and may no longer be visible in the marshy ground. Excavation of a length of 120 fathoms (219.6m) along the lode would have brought the adit to just beyond Henry's Shaft, **Mon 1109**. The name of this adit suggests that it was dug during the period of James Henry Deacon's administration, ie. from *c.* 1815 to *c.* 1843. (Cook *et al* 1974, 165) According to the April 1847 report, it was begun after the Two Brothers' Adit, at greater expense, and it was still in progress when the mine closed in 1844. (MJ 10.4.1847; 6.3.1847) Little progress seems to have been made after 1847. Capts. Gregory and Spargo recommended clearing this adit "so as to sink on this bunch of tin" (MJ 12.6.1847), though there is no documentary evidence of such work.

iv) Deep Adit

The contemporary plans of Eylesbarrow mark the positions of "Deep Addit Shaft" and "Shaft at the deep Addit mouth". (WDRO WW21, WW20a) Thus these must be connected with Deep Adit, marked on the pre-1847 section. (WDRO WW20b) As noted above, references to a deep adit in the Mining Journal after 1847 correspond with Deacon's Adit. Furthermore, no shafts on the pre-1847 section reach Deep Adit. This suggests that, by 1847, Deep Adit is obsolete, but, as in the case of Shallow Adit, its existence was recorded on the section.

The position of the Deep Adit mouth has not been located. The scale of the contemporary plans may not be wholly reliable. However, the distances on both plans between Deep Adit Shaft and the "shaft at the deep Addit mouth" are in a similar ratio (1:1.33) to the distances between Deep Adit Shaft and Jenkins Shaft. The survey plan demonstrates that Jenkins Shaft, **Mon 1108**, is 140m from Deep Adit Shaft/Wheelpit, **Mon 1111**. Therefore, it may be suggested that the mouth of Deep Adit is approximately 105m NW of **Mon 1111**, ie. SX 5920 6827. The same location is also exactly 60 fathoms from the mouth of Two Brothers' Adit. Therefore, although it is not due W, it would also be appropriate for the mouth of Deacon's Adit.

Furthermore, a reconstruction of Deacon's Adit indicates that its route from its exit to Henry's Shaft, **Mon 1109**, crosses Deep Adit Shaft, **Mon 1111**. This raises the possibility that Deacon's and Deep Adits are one and the same. However, the presence of both on the pre-1847 section renders this unlikely. It is important to note that Deep Adit is not necessarily deeper than Deacon's Adit; it may simply follow a different route. Thus it is possible that the two adits share the same exit and follow the same course through Deep Adit Shaft but then diverge. Deacon's Adit continues to Henry's Shaft, but it is not clear where Deep Adit might have proceeded eastwards. On contemporary plans, Jenkins is the only other shaft in this part of the sett. There is a strong possibility that this adit was intended to be worked, prior to the 1840's, in conjunction with Jenkins and the other two shafts, as a self-contained unit of Eylesbarrow Mine. There is no documentary evidence that Deep Adit reached Jenkins Shaft; the latter is not shown on the pre-1847 section, while, on the plans, it is simply recorded that Jenkins had been sunk 9 fathoms between 1823 and 1831, and 15 fathoms after 1836. (WDRO WW20b, WW21, WW20a) However, a shaft 15 fathoms deep might easily reach this adit; the depth of Deep Adit Shaft (9 fathoms), which must have been connected to Deep Adit, suggests that the Deep Adit was only 9 fathoms below the surface at this low elevation.

There is a slight possibility that Deep Adit has a longer history. A tinwork "South Deepworks", documented in 1642, is marked on the plans of Eylesbarrow Mine in the small valley, into which "Deep Adit Mouth" opens. (WDRO 72/990/91; WW21 and WW20a) It is tempting to interpret "Deepworks" as a reference to the deeper underground working of an adit, in contrast to contemporary shallow workings on the surface.

v) A fifth adit is recorded on the post-1836 plan, on the N bank of the R Plym, immediately upstream from the headweir of leat, **Mon 1194**, which served the stamping mill, **Mon 1185**. (WDRO WW20a) Presumably, this adit continued northwards, connecting with **Mon 1199** and possibly **Mon 1201**.

b) Shafts

While some of the shafts are obviously named after people, such as Sutton, Henry's and Jenkins, the titles of others can also reflect their function. Thus Old Ladderway and New Footway Shafts were presumably used for access. (WDRO WW21 and WW20a) A horse whim was located next to Whimb Shaft (WDRO WW20b), while the Old Engine and New Engine Shafts must have been connected to the engine wheel for pumping. (WDRO WW21, WW20a and b) 26 main shafts, as well as numerous smaller pits, have been recorded in UPV, most of which have been identified with the aid of documentary evidence. These are summarized in Table 5;3 and described in detail in App.F.

Most of the shafts correspond directly to shafts marked on the contemporary plans and section. (WDRO WW21, WW20a and b) However, accounts in the Mining Journal suggest that two alterations may be made. Firstly, **Mon 1140**, clearly corresponds to Barrack shaft but there is a possibility that it was later known as New Engine shaft. The latter is marked on the pre-1847 section but is otherwise difficult to equate with archaeological remains. According to the section it was situated between Hawk and Old Engine Shafts and was sunk below Two Brothers' Adit. The difficulties arising from names, such as "new" are noted above. However, this pre-1847 New Engine Shaft probably corresponds to the "present engine shaft", described prior to the 1847 re-opening, which seems to have been sunk to the 10 fathom level [ie. 10 fathoms below Two

Table 5:3 Summary of Eylesbarrow Shafts.

Mon.No.	SHAFT NAME	ASSOCIATIONS: ADIT	ASSOCIATIONS: ENGINE-WHEEL	ASSOCIATIONS: FLAT-ROD SYSTEM	FEATURES OF INTEREST
1104	Whimb	Two Brothers			Horse-whim.
1107	New	? Two Brothers			
1108	Jenkins	? Deep			
1109	Henry's	Two Brothers Deacon's			
1111	Deep Adit	Deep			Reused as wheel pit
1116	Sutton	Deacon's			
1131	?	? Shallow			
1132	Hawks	Shallow	Mon 1097	Mon 1103a	
1140	Barrack/?New Engine	Two Brothers	Mon 1097	Mon 1103c	
1141	Old Ladder Way				Used for access.
1148	Old Engine	Two Brothers	Mon 1097	Mon 1103c	Bob-pit.
1150	New Footway	Shallow			Used for access.
1152	Whitford/Widford	Two Brothers			
1153	Henry's Engine		(Mon 1097)* Mon 1111	(Mon 1103b)* Mon 1114a	Horse-whim and Bob-pit.
1154	Pryce Deacon's	? Two Brothers			2 Horse-whims and Bob-pit.
1166	?		Mon 1111	Mon 1114a & b	Bob-pit.
x 23	Philip/Philips				Horse-whim
x 24	?	?			
x 25	Midsummer	? Two Brothers			
x 26	Michaelmas	? Two Brothers			

(+ 6 shafts at Wheal Katherine, Mons 1183, 1187, 1189, 1190, 1199 and 1201).

* = Not Used.

Brothers' Adit]. This was situated "between the caunter lode and cross-course" about 200 fathoms (366m) from the wheel. (MJ 6.3.1847) It is also probably the "new engine shaft", described in July 1847, opening into Two Brothers' Adit between Whim (**Mon 1104**) and Old Engine (**Mon 1148**), and distinguishable on the surface by "the large lift of pumps ... above the mansion house". (MJ 10.7.1847) The New Engine Shaft is not marked on contemporary plans so that it is necessary to look for a shaft at a place between the mansion house (ie. Account House), **Mon 1134**, and Old Engine Shaft, **Mon 1148**, where it could be pumped by the engine wheel, **Mon 1097**, 366m from the wheel. The possibility that it might be a shaft on the North lode, pumped by the flat-rod system, **Mon 1103b**, is over-ruled by documentary evidence that the lodes in this area had "never been worked upon, except by the old men, or ancients." (MJ 5.6.1847) Therefore, New Engine Shaft has to be on the South lode, pumped by **Mon 1103c**. The shafts, recorded in the field on the S lode, are all already accounted for. Therefore, the title of New Engine may have been applied to a shaft previously worked under a different name, when it became an engine shaft. Barrack and Philp both lie on the line of the flat-rod system, **Mon 1103c**, but Barrack, at 355m from the wheel is the most likely.

Secondly, **Mon 1153** seems to be Henry's Engine Shaft, a shaft not previously recorded on the plans and section. Capt. Gregory's inspection of Two Brothers' Adit in July 1847, which went through "Henry's Shaft" and eventually to "near Henry's Engine Shaft", demonstrates the repetition of the same shaft-name. (see documentary extract 7) Unfortunately, in many reports, "Henry's Engine" is abbreviated to "Henry's". However, details of progress at the shaft usually indicate which of the two is under discussion. Thus the report on 9th June 1847, that "we have walled up the collar of Henry's Shaft ... to haul the tin and rubbish from Two Brothers' Adit", must refer to **Mon 1109** at the W end of the adit, if this shaft was of use at the beginning of repair-work. (MJ 12.6.1847) A later report refers to "Henry's shaft, which is now at the depth of 15 fathoms from surface". (MJ 3.7.1847) This is clearly not **Mon 1109**, which was already sunk to the Deacon's Adit level.

References in the same and later reports to Henry's Engine Shaft suggest that this equates with a "new engine shaft ... already sunk 15 fathoms", first recorded on 26th June. (MJ 26.6.1847) This "new engine shaft" cannot be the New Engine Shaft, which was recorded on the pre-1847 section, as it had been sunk below Two Brothers' Adit. Therefore, reports in the Mining Journal indicate the existence of a shaft, not recorded on the contemporary plans and section (and thereby providing a *terminus ante quem* for these documents.) Evidence in the Mining Journal suggests that Henry's Engine Shaft corresponds to **Mon 1153**.

Firstly, **Mon 1153** is situated, as Henry's Engine Shaft, between Old Engine Shaft, **Mon 1148** and Pryce Deacon's Shaft, **Mon 1154**. (MJ 10.7.1847) (See documentary extract 7) Secondly, **Mon 1153** lies 120m W of Pryce Deacon's, which accords reasonably well with Capt. Gregory's statement that Two Brothers' Adit reached a point "near Henry's engine shaft, which is not 100 fathoms (183m) from ... Pryce Deacon's shaft". (MJ 10.7.1847) Thirdly, and more significantly, may be the position of **Mon 1153**, in relation to the two engine wheel houses, **Mon 1097** and **1111**. When Henry's Engine Shaft was first sunk, at some time prior to 26th June 1847, the adventurers may have intended to use the original wheel house, **Mon 1097**. Capt. Spargo reports that "I have minutely examined the axle of the large wheel, and find it of sufficient strength to build a wheel 45ft diameter if required", but there is no indication at this time of the construction of a new wheel house in a different location. (MJ 26.6.1847) However, the following issue includes a recommendation to "remove the engine-wheel from where it now is, to the tail of Two Brothers' Adit". (MJ 3.7.1847) **Mon 1153**, intersected by projected lines of both flat-rod systems, **Mon 1103b** and **1114a**, is thus ideally placed for pumping by either engine.

This has further implications: it suggests that the location of **Mon 1111** was partly dictated by its eventual connection with **Mon 1153**. Furthermore, it provides an alternative explanation for the abrupt end of **Mon 1103b**: rather than later damage, caused, for example by refurbishment of the mansion house, this flat-rod system may simply never have been completed.

Finally, archaeological evidence supports the identification of **Mon 1153** with Henry's Engine Shaft. The bob-pit on the W side demonstrates its use as an engine shaft, while the horse whim, recorded on 9th December 1847, is still visible on the S side. (MJ 11.12 1847) Cook, Greeves and Kilvington did not record Henry's Engine Shaft, but **Mon 1153** is probably the shaft with a bob-pit, which they equate with Whitford's Shaft. (1974, 182)

5.6.2 Methods of Excavation

Documentary evidence for Eylesbarow and other mines gives some indication of the excavation methods in an underground mine.

a) Excavation of Adits and Shafts

Drainage was probably the primary function of the earliest adits, though they also provided access through the mine; ore could be transported along adits in wheelbarrows, or later in wagons on rails, to the adit mouth or to a hoisting shaft. In order to "open up the ground and handle the ore", adits or levels "were driven into the lode at intervals as the workings went deeper usually every ten to twelve fathoms." (Earl 1968, 50)

The earliest shafts were merely deep pits, excavated through the lode. They were probably small and worked indivually so that a single shaft accomodated hoists for ore, equipment and men as well as baling devices. In later large-scale enterprises different shafts could have different functions. (Pryce 1778, opp. p172, Pl.IV) The significance of Engine, Whimb, Old Ladderway and New Footway shafts at Eylesbarrow has already been noted while many shafts may have been simply air holes to improve ventilation below. (Earl 1968, 65) Early shafts often followed the lode and were rarely straight. However, later, shafts were sunk vertically through country rock to meet the lode at depth, which greatly facilitated hoisting. (Earl 1968, 65-6)

The first step must have been to ensure that the shaft or adit mouth was supported. Pryce recommended timber shoring, known as "collaring" in a shaft and "binding" or "timbering" in an adit or drift.

> "If the ground is very loose on all sides, they make a Durns, as they call it, which for a shaft is square like the frame of a window, and for an Adit is the same as a door case. Between the Durns and the country they thrust in deal boards, whose extremities length ways are just placed behind each Durns." (1778, 166)

An early recorded example is the old shaft discovered at Hensroost, when the Hexworthy Tin Mining Company re-opened the workings in the late

19th century. This still contained oak beams to prop up the sides of the shaft. (Burnard 1891a, 97) The good condition of the beams suggests that the shaft had not been abandoned for very long and was possibly first excavated in the 18th or early 19th centuries.

However, in at least two Eylesbarrow shafts, **Mons 1140** and **1183**, as well as the four Shavercombe shafts, **Mons 993-5** and **1003**, circular stone linings are visible at the top of the shafts. Presumably in UPV local supplies of strong timber were limited and stone linings may have been common. Another example was found in 1820 at Birch Tor possibly dating to *c.*1750. (Burnard 1891a, 97 ; Hemery 1983, 614)

Pryce recommended different diameters of shafts according to the ground conditions and purpose of the shafts. (1778, 144) Thus a wider shaft provided a larger space for working in hard ground. A shaft intended to have a whim at the surface should be at least 6ft (1.83m) by 4ft (1.22m), while a steam engine shaft should be at least 9ft (2.75m) square or 10ft (3.05m) by 8ft (2.44m). (*ibid.*) The cross-section of the shaft probably depended on the pit-prop material; Davies points out that dry-stone adheres more readily to a circular shaft, while a rectangular shaft is more appropriate for timber work. (1935, 23) Pryce suggested that eight men could sink a working shaft in hard ground in four six-hour shifts of two men, while six men could dig in soft ground in three eight-hour shifts of two men. (1778, 144)

Standard drifts or adits in the late 17th century were supposed to be 7ft (2.14m) high and 3ft (0.92m) wide, though frequently they were smaller. (Hamilton Jenkin 1962, 87) For example, at Great Week Mine in Cornwall, pre-19th century cross-cuts were in places only 4ft (1.22m) high and 2ft 4ins (0.71m) wide. (*ibid.*) Pryce thought 6ft (1.83m) high and 2½ft (0.76m) wide would usually suffice for an adit for working and removing rubble by wheelbarrow. (1778, 146)

Considerable effort was required in digging adits and shafts, particularly through hard ground. In Carew's time Cornish miners could mostly

> "make speedy way, and yet (not seldom) are so tied by the teeth as a good workman shall hardly be able to hew three feet in the space of so many weeks." (1811 ed., 37)

Tonkin in 1733 noted that it could even take three months to drive three feet. (1811 ed., 37) The cost of driving an adit in Pryce's time varied from 4sh a fathom through soft growan [decayed granite] to £35 per fathom through irestone. The partly decayed granite in the Eylesbarrow area may have presented a relatively straightforward task. A shareholder visiting the mine in 1847 calculated that "the cost of driving would be from £2 10s to £3 per fathom ... as the ground is soft and easily worked". (MJ 5.6.1847) and Capt. Spargo estimated £10 per fathom for sinking shafts. (MJ 3.7.1847)

b) Stoping

The position of the shaft had to be carefully calculated to reach the lode 20 to 30 fathoms down. (Pryce 1778, 143) Once reached, miners worked in horizontal drifts either above or below the usually inclined lode and work generally proceeded by "stoping" or cutting a series of steps. In direct or descending steps (underhand stoping) tinners followed a method similar to the openwork shammelling, by digging down on the lode from above. (see Fig. 5:17) In reverse or ascending steps tinners attacked the lode from below. This method, known as overhand or back stoping, was thought by RN Worth to have been introduced to SW England no earlier than the late 18th century and mostly replaced underhand stoping. (1872, 14) "In either case the excavations are disposed in steps like a flight of stairs upon its upper or under side." (Simonin 1869, 402-3) Fig. 5:18 may illustrate a typical scene. Four men are engaged in underhand stoping at the deepest part of the mine, while overhand stoping can also be seen at the adit level. Ore is raised by bucket and windlass to an adit, where wooden boards aid the transport of ore by barrow. The excavation of a "winze" or intermediate shaft between two levels aided air circulation as well as movement of ore. These were dug at horizontal intervals of about 50 fathoms. (Earl 1968, 50) Early miners often disposed of waste or "deads" in worked out parts of the mine, but improved hoisting capacity may have allowed a greater quantity of material to be raised and sorted on the surface. (RN Worth 1872, 14)

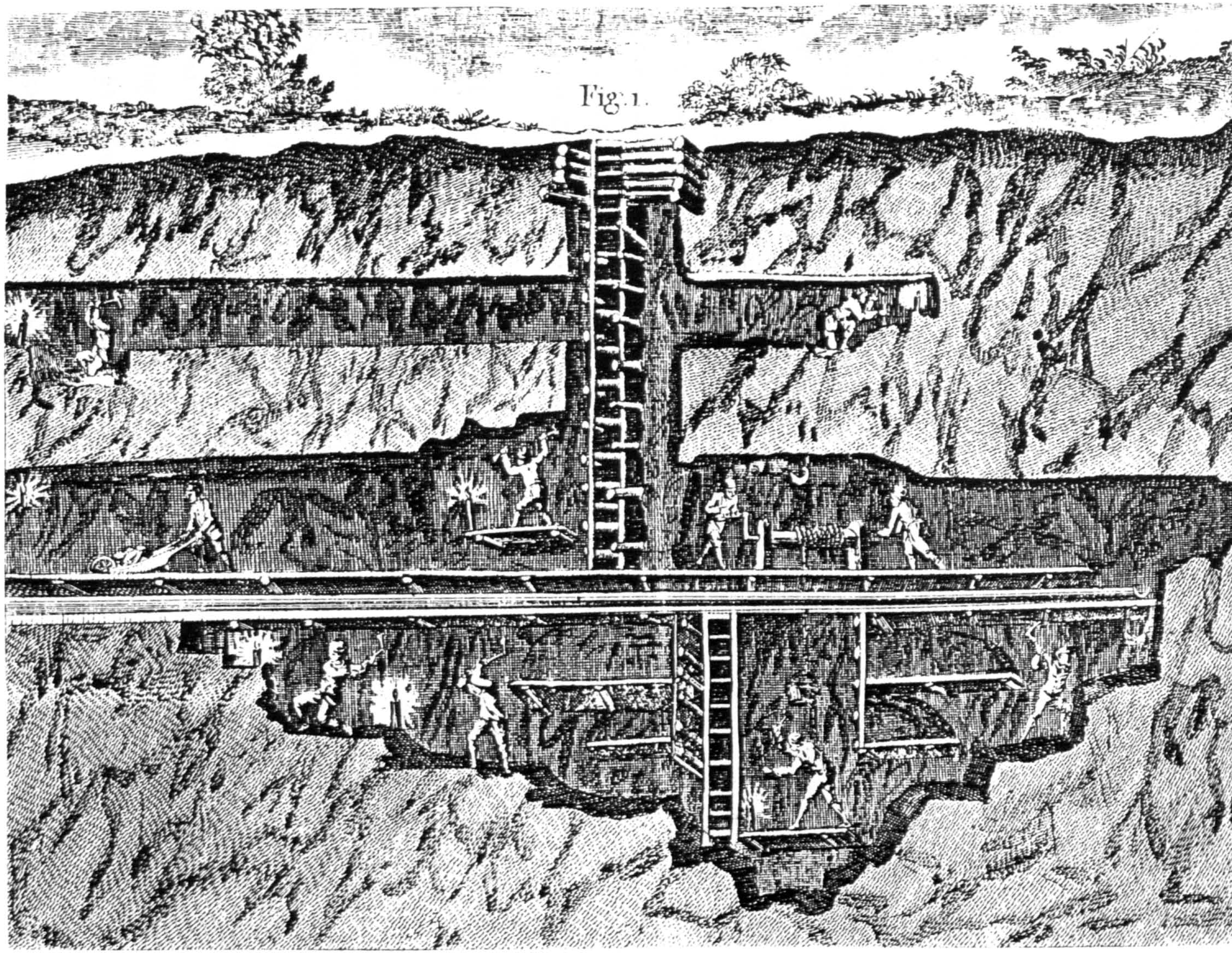


Fig. 5:18 A cross-section through a mine
(from Diderot 1959 ed. Plate 131)

c) Shoring

As well as propping up shafts and adits, it was essential during excavation of the lode, to support its roof or "hanging wall". In the 16th century, Hooker was well aware that the underground miner was "in greate daunger" from falling rock (see above p.420) and even timber shoring did not always provide sufficient protection. According to Carew:

> "The loose earth is propped by frames of timber-work as they go, and yet now and then falling down, either presseth the poor workmen to death or stoppeth them from returning." (1811 ed., 37)

The usual remedy was to wedge massive timber pillars, known in Cornwall as "stemples", at intervals between floor and roof, occasionally creating the impression in a wide lode of "the aile of a venerable piece of Gothick architecture." (Pryce 1778, 161) Photographs taken underground in Cornish mines at the turn of the 19th/20th centuries illustrate the different degrees of shoring. The single pillar sufficient in one place (Barton, n.d., 17), may be compared with the series of massive timbers required to support the hanging wall at the 394 fathom level at Cooks Kitchen Mine. (*op.cit.*, 27)

It has been suggested that excavations through Eylesbarrow ground would have been relatively easy to support, as partly-decayed granite tends to be "coherent". (Cook *et al* 1974, 200) Furthermore, very wide excavations would not have been necessary as the Eylesbarrow lodes were only about 1ft 8ins wide, occasionally reaching 3ft. (MJ 6.3.1847; 10.3.1847; 12.6.1847) However, problems were encountered; prior to the 1844 closure, work on a shaft at the E end of Two Brothers' Adit was halted by flooding and "the softness of the ground". (MJ 6.3.1847) Shoring was probably a major part of work in the "timber house", **Mon** 1130 at Eylesbarrow.

Strong timber may have been a precious commodity on moorland Plym and to save timber. parts of the lode were left *in situ* as supports, as recommended by Pryce. (1778, 161) Thus the 1836-44 adventurers had left "several good arches of tin", which Capt. Spargo intended to remove in 1847 as soon as he had sufficient timber. However, these had to remain "as there is a quantity of ground supported by them; and should we take them away, we cannot secure the ground ... without great expense". (MJ 15.5.1847; 12.6.1847) Shoring must have required careful maintenance, particularly if mining ceased periodically. Re-timbering constituted a major part of repair-work preparatory to the re-opening of Eylesbarrow Mine in 1836 and 1847. (MJ 9.12.1847; 12.6.1847; 26.6.1847; 3.7.1847) Pryce stressed the importance of shoring and the skill of the "binders" and "timbermen", who had to calculate costs against safety, and "who, according to their reported excellence, have very great wages." (1778, 167)

d) Equipment

Early mining acheivements were made with a limited range of equipment. Elizabethan miners had only:

> "a pickaxe of iron about sixteen inches long, sharpened at the one end to peck, and flat-headed at the other to drive certain little wedges wherewith they cleave the rocks. They have also a broad shovel, the utter part of iron, the middle of timber, into which the staff is slopewise fastened." (Carew 1811 ed., 35)

The pickaxes are similar to the "iron tools" used in 16th century Germany and the shovels are similar to the one found in Luxulyan streamworks, Cornwall. (Agricola 1950 ed., 150 Fig; RN Worth 1874, 128 Fig) The frugal use of iron in the manufacture of the shovel suggests that iron was a precious commodity. Earlier shovels were entirely of wood; Penhallurick illustrates two wooden shovels found in a streamwork at Boscarne, W of Bodmin, one of which was radiocarbon-dated to between AD 635 and 1045. (1986, 211-2) By the late 17th century, tools had changed little, and consisted of a beele or Cornish Tubber, which was a double-pointed pick of 8lbs to 10lbs weight, a sledge-hammer of 10lbs to 20lbs weight, and gadds or wedges of 2lbs weight. (Greeves 1981, 158) All tools wore down quickly especially in hard ground. Thus wedges required sharpening every two or three days, and beeles every two weeks. (*ibid*) Increased iron supply, by 1733, may have permitted the use of long-handled shovels, completely of iron. (Tonkin 1811 ed., 35)

Similar tools were probably in use in Dartmoor between the 16th and 18th centuries. The pick found in 1890 in an old adit, 15 fathoms below the surface on Down Ridge at Hexworthy is much lighter than the Cornish beele. Only 3/4lb in weight and 5ins long, it has a single point and a slight contraction in the middle. (Burnard 1891a, 97, Fig opp 98) Another pick was found in Wheal Unity Tin Mine, Petertavy in the late 18th century in a part abandoned for at least 80 years. (Greeves 1981, 150) Two gadds of about 1½lb weight were also found at Hexworthy. (Burnard 1891a, 98 Fig) One was much used and 4½ins long and the other was little used and 5½ins long. (*ibid.*) Burnard warned that although these were found among mining remains, such wedges were not exclusively mining tools, and were frequently used for granite splitting, for example in the manufacture of gateposts. (*ibid.*) By the mid-19th century, mining tools used on Dartmoor may have been very similar to those manufactured by Harvey and Co. of Hayle, Cornwall in *c.* 1880. (Earl 1968, 110 Fig)

e) Mining Procedure

The early mining methods were probably very similar to the manner of granite splitting, in which an iron rod was hammered between two wedges into a rock crack or a chiselled groove. (Earl 1968, 35; Harris 1968, 73) After *c.* 1800, in the process known as "feather and tare", the initial hole was bored with an iron bar or "jumper", (Harris, 1968, 73-4) though by this time gunpowder was in general use underground.

To the early miners, working with picks and gads, fire would have been a great assistance. (See Fig. 5:19) Simonin described the procedure:

> "Horizontal layers of billets of firewood disposed cross wise above one another, are piled up in a nearly vertical position so as to present four free vertical faces (whence the pile has been called a chest by the miners), and set fire to. The flame plays on the face of the ore which becomes shattered and traversed by cracks, and when cooled is very easily detached with the pick, or long iron forks." (1869, 410)

Further details are provided in an account, related by Penhallurick, of fire-setting in tin mines of Geyer district, E Germany. (1986, 73-4) The construction of a latticed framework such as that described by Simonin was intended to direct the fire upwards, for the purpose of overhand stoping. (*ibid.*) In driving levels, the fire was directed horizontally and a wall of ore constructed round the upper and rear parts of the pyre to shield the roof and the rest of the gallery. (*ibid.*)

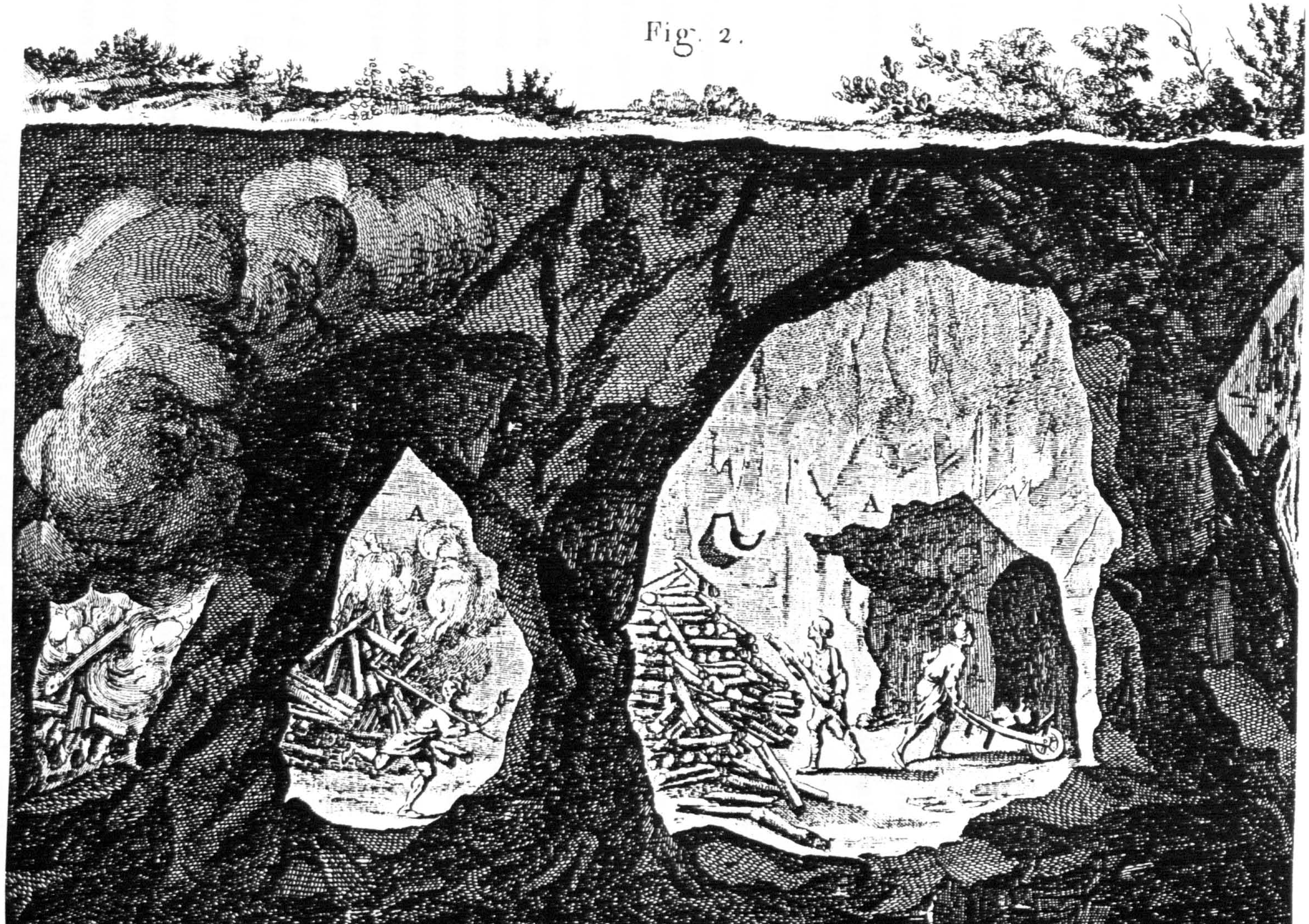


Fig. 5:19 Fire-setting (from Diderot 1959 ed Plate 132)

Although these accounts all relate to mines of C Europe, fire-setting was also known in W England. Tonkin noted the use of furze or faggots for fuel (1811ed., 37) Fire-setting was slow but effective and probably the only means of driving through hard rock. Pouring cold water on the heated rock increased splitting and, Gerrard (1986, 245) suggests that fire-setting was the main purpose of the openwork reservoirs. (see above p.416) It was still in use at Rammelsberg Mine in the late 19th century and was only surpassed by the introduction of steel borers and dynamite. (Simonin 1869, 410; Penhallurick 1986, 74)

However, fire-setting did have disadvantages; miners were in danger from the smoke, (Tonkin 1811 ed., 37) which is presumably the reason why in Rammelsberg Mine, fires were burnt over the weekend and extinguished when miners returned to work on Mondays. (Simonin 1869, 411) Quicklime may also have been used. (Earl 1968, 36)

In the late 17th century, gunpowder was introduced to mining in Cornwall and probably also Devon. (RN Worth 1872, 17). The construction of a strong building to store gunpowder was presumably standard practice. Two powder houses, **Mons 1128** and **1137**, with thick mortared stone walls were built for Eylesbarrow Mine. These were probably contemporary as both appear on the 1823-36 plans. (WDRO WW21 and WW20a) Two houses may have been thought necessary, though both are unusually close to the accomodation quarters. The introduction in the 1860's of high explosives, which were three times as effective as gunpowder, came too late for Eylesbarrow Mine. (Earl 1968, 4)

5.6.3 <u>Unwatering</u>

a) <u>Early Methods</u>

The major pre-occupation of mines and mine-owners, on which the success of the venture could depend, was underground water. The depth, to which the lode could be pursued depended on the ability to unwater the workings. Carew describes the constant effort required:

> "The springs so encroach upon these inventions as in sundry places they are driven to keep men, and somewhere horses also, at work both day and night without ceasing, and in some all this will not serve the turn."
> (1811 ed., 38)

The earliest method may have been to raise water in buckets, or "kibbles", by a windlass. Leather buckets were the sole method of unwatering in the silver lead mines at Birland, prior to the introduction of the adit in 1303. (Hamilton Jenkin 1962, 83) The use of adits marked a significant step in the development of the mining industry and may have allowed year-round working for the first time in many mines as well as Birland.

However, the problem of unwatering continued, where shafts were sunk below adit level. From the 16th century onwards, in the tin industry a wide range of equipment was introduced and different power supplies harnessed to counteract this problem. Particular equipment and power supply were selected according to available capital, manpower or horsepower and to the nature of the work. Thus the hand-worked windlass and buckets continued to be used through the centuries alongside more powerful machinery. Prolonged use was achieved at a high cost in human labour, and the hand-powered windlass was superceded for major unwatering operations. However, this simple apparatus could be cost-effective in unwatering shallow pits not connected to the main pumping shaft.

Such a device, simply constructed and portable may well have been used in UPV, in early streamworks and openworks. Even when superceded by water-powered pumps, it may still have been useful at the 19th century Eylesbarrow Mine, for particular operations, such as raising the "bucket" from a bucket pump. (See below p.439) (Michell and Letcher 1876, 212) The "capstan rope" listed in the 1852 advertisement for the sale of equipment suggests that such a device was used for some purpose. (see Fig. 5:2) (MJ 25.9.1852) At some time, possibly in the 17th century, the windlass was adapted to horsepower; though this may have been used for unwatering, it was probably employed more often in raising ore. (See below p.464)

b) Pumps

An early type of pump was the rag-and-chain. This consisted of an iron chain, to which leather-bound balls of cloth were fixed at intervals of two to three feet. By turning the chain round a wheel or drum, the leather balls were drawn through a wooden pipe of three to eight inches diameter and twelve to 22 feet long, bringing with them a quantity of water. (Borlase 1758, 171; Pryce 1778, 150; Agricola 1950 ed., 191 Fig) Possibly used on Roman mines, the hand-worked rag-and-chain was still in use, for example at Wherry Mine, Penzance at the end of the 18th century.

(Michell and Letcher 1876, 134) It could also be adapted to horse- or water-power. Evidence of its use is not likely to survive but, like the hand-windlass, it could have been useful in UPV in isolated locations underground, or in the early streamworks or openworks. Similar to the rag-and-chain is a device, in which an endless chain of pots scooped up water. (Earl 1968, 36)

The introduction of suction pumps greatly increased efficiency and flexibility. These depend on the action of a piston creating alternately negative pressure (a vacuum) and positive pressure in a chamber, which is provided with a non-return valve at each end. An early pump, which was well-established in Cornwall and presumably Devon by the 16th century, was the Bucket Lift (Bucket Pump or Drawing Lift) (Earl 1968, 37; Barton 1965, 90-91) (See Fig. 5.20a) This consisted of:

> "a plunger, known as a "bucket" [which was] worked up and down in a pipe by rods. The bucket was made to fit the pipe closely - usually by leather-packing - and had holes covered by a flap which acted as a valve. A similar flap was built into the pipe near the bottom, and when the bucket was pulled up, [creating a vacuum] it sucked the water up past the flap of the bottom valve, the bucket's valve remaining closed. On the downstroke of the bucket, [creating positive pressure] the bottom valve closed, the bucket's valve opening as the water was forced through it and above the bucket. On the next upstroke more water was drawn into the pipe through the lower valve, to be pushed above the bucket on the downstroke. In this way the water was lifted up the pipe in a series of "plugs". (Earl 1968, 37)

"Bucket rods" working at the bottom of a shaft could be attached by chains to the power supply on the surface. Water could be brought to grass or be discharged into an adit. Bucket pumps were used in Cornwall until after *c.* 1810, after which the plunger pump (or force pump) was more common except for the bottom lift. (Earl 1968, 39) (See Fig. 5.20b) These still relied on negative pressure to suck water from a sump into a chamber, but it was the downward stroke of the plunger, which forced water up from cistern to cistern. (Earl 1968, 40) These had several advantages over the bucket pump; working on the downstroke, rather than on the upstroke, they utilized gravity, while the separation of the piston from the pump column probably facilitated maintenance and removed the necessity of having the pump column (and water outlet) in the same shaft as the plunger (and therefore power supply). However the bucket lift continued to be the most effective pump at the bottom of a shaft; it is more easily repaired if pump failure caused flooding at the bottom. (Earl

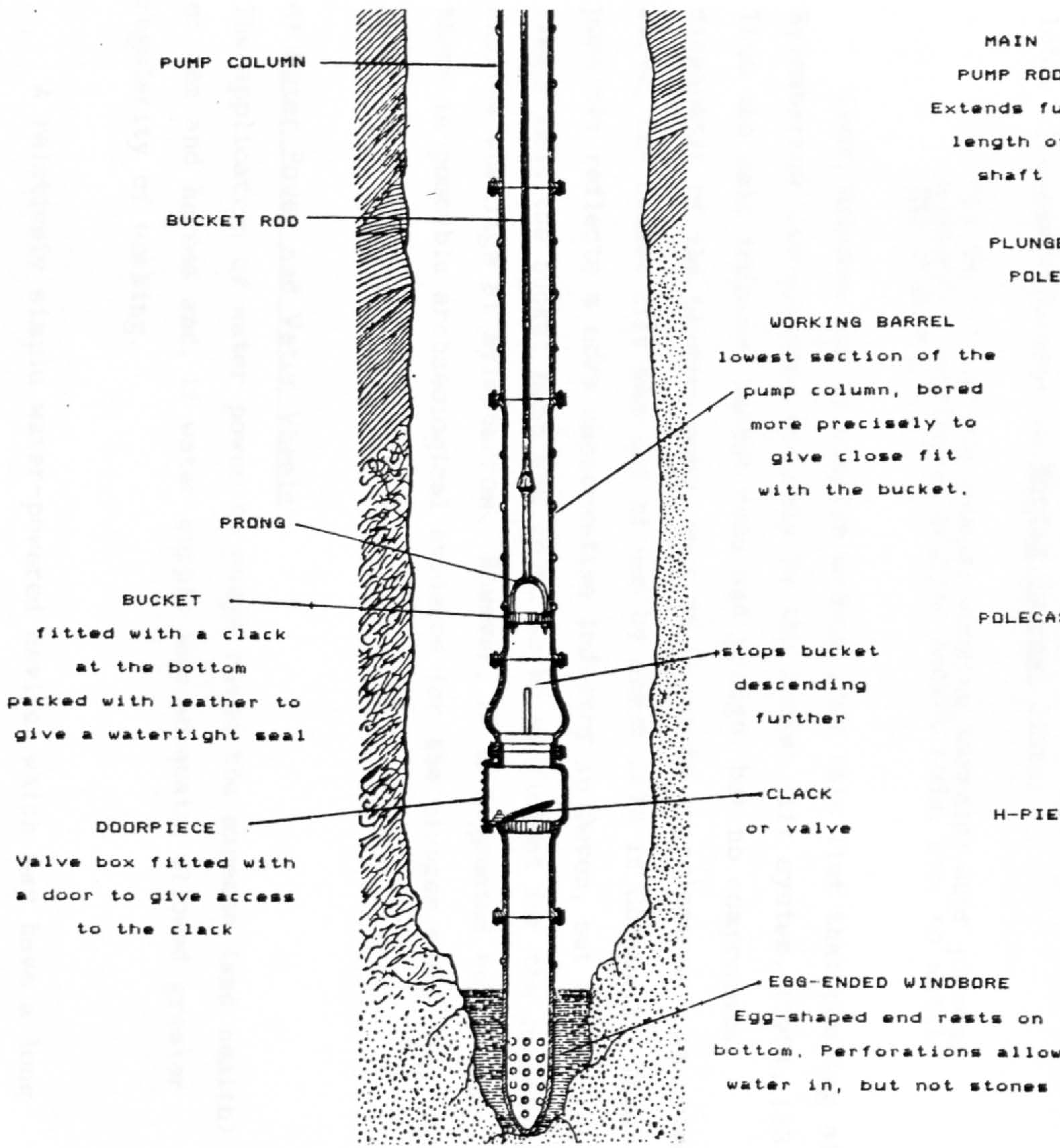


Fig.5:20a The bucket or drawing lift

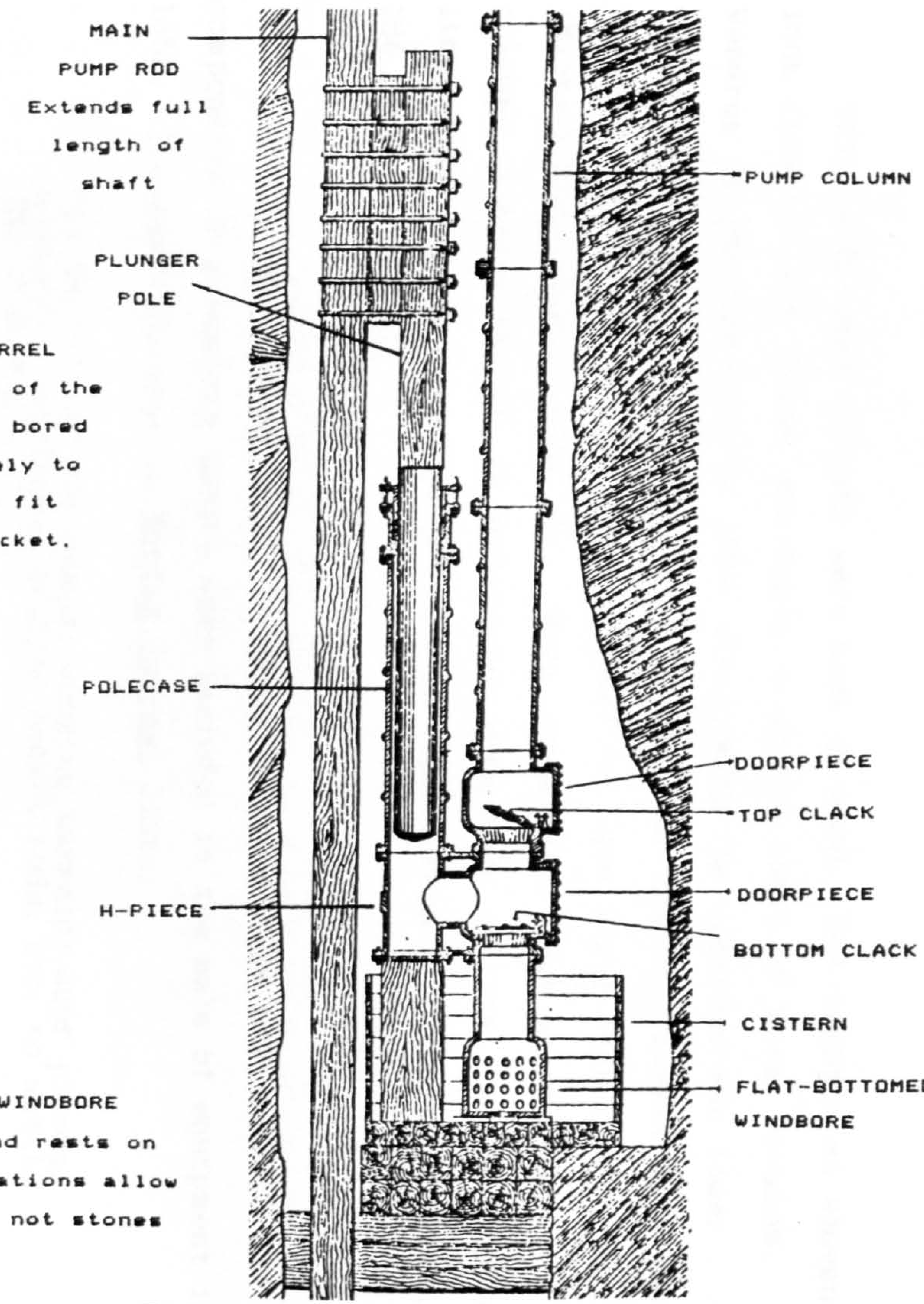


Fig.5:20b The plunger or force pump

(After Michell and Letcher 1876 fig 84)

1968, 39) Furthermore, during sinking it is a simple operation to lower a bucket pump and add an extra cylinder to the top of the column. (Barton 1965, 90-2)

Originally pump columns were made of wood. For example an eleven-inch diameter elm column was found in an old shaft at Wheal Freedom, Wendron parish, Cornwall in 1855, along with the windbore and lower valve. (Hamilton Jenkin 1962, 98)) In the 19th century, bucket rods were timber or iron, the latter being lighter but less rigid than the former. (Michell and Letcher 1876, 143) When components, such as the pump columns, working barrels or doorpieces were made of iron, they were often lined with wood or brass to prevent corrosion from mine water. (*op.cit.*, 156,191)

There is no archaeological evidence of pitwork in UPV, but components of a pumping device were included in the sale of equipment in 1852. The advertisement in Mining Journal lists:

> "10 fm lift of 8in pumps; working barrels; door pieces, windbores, castings, prongs; bucket rods, etc. to match." (MJ 25.9.1852)

Cook, Greeves and Kilvington deduce from this list that pumping at Eylesbarrow was effected entirely by the bucket lift system. (1974, 183) Thus the sale includes bucket rods and prongs, but no components diagnostic of the plunger pump, such as H-pieces or polecases. As noted above, the bucket lift was out of use by about 1810 in Cornwall. This possibly reflects a more conservative industry in Devon, but it is more likely that the bucket pump was found to be sufficient for the relatively shallow workings at Eylesbarrow. However, it is suggested below that there is possible archaeological evidence for the plunger pump. (See below p.462)

c) Water Power and Water Wheels

The application of water power to pumps saved the expense (and health) of men and horses and, if water supply was adequate, allowed greater regularity of working.

A relatively simple water-powered device, which may have a long history, is the "flop-jack" or beam engine. (FN This is not to be confused with the steam-powered Cornish Beam Engine though the principles of the balance or beam is the same.) This consisted of:

> "a horizontal beam, one end of which was connected to the pump and which operated the normal bucket pump whilst the other carried a tank fed by water from a launder above. The tank, as it filled with water, slowly descended, thereby raising the pump rod and at the bottom of its stroke, when full, the tank was emptied by a trip which opened a hatch in its base. This enabled it to rise again to be filled and so to descend once more." (Barton 1968, 179)

Such a method of pumping could be effective, though obviously slow. Sluice gates would be required to control the flow of water to the tank, and care would have to be taken to divert the emptied tank water well away from the workings. It was suggested above that such a pump could have operated at shafts, **Mons 1154** and **1150**, powered by water from reservoirs, **Mons 1156** and **1157**. (See p.418) Despite competition from more sophisticated machinery, at least one flop-jack is recorded in the 19th century in Cornwall; a working, ten fathoms deep, at Trewolvas Mine, St. Columb was unwatered, albeit inadequately in 1835 by a flop-jack engine. (Barton 1968, 179) A beam engine or a more simplified version with two buckets at either end of the beam could have operated in early shallow workings in openworks or streamworks.

For centuries the water wheel was widely used for milling and from at least 14th century for stamping. Thus "the harnessing of a wheel to a bucket pump for mine use ... was an obvious step forward in the extension and adaptation of water power for mining purposes." (Barton 1968, 150) Early pumps were worked by small wheels, 12ft to 15ft in diameter. (RN Worth 1872, 29) Deeper workings could be unwatered by a series of these wheels, each operating separate pumps. (Lewis 1908, 11) Later these were replaced by a single large wheel, which could work several tiers of pumps. In the late 18th century, a 48ft wheel at Cook's Kitchen Mine, Cornwall worked 9inch pumps in four stages or "lifts" and raised water 80 fathoms to adit level. (Pryce 1778, 151-2)

Two separate water wheel - driven pumping systems were erected at Eylesbarrow and possibly one at Wheal Katharine, **Mons 1097**, **1111** and **1200**. Each was powered by a single wheel, which was presumably sufficient for the relatively shallow workings on Eylesbarrow Hill. The wheels have long since been removed and all that remains are the wheel-houses or wheel-pits. Some inferences can be made from the archaeological evidence while further details can be found in the documentary record.

i) **MON 1097**

The rectangular engine wheel-house consists of a solidly - constructed coursed wall of large granite blocks. (See Fig 5:21 and Plate 5:2) The wall is now tumbled but was originally 0.90m wide. The countersunk wheel-pit within is partly obscured by rubble, but a sufficient number of faced stones is visible to indicate a width of 0.80m (2ft 7inches). An original length of approx. 8.70m (28ft 5inches) may be estimated. This wheel-house was part of the first 19th century operations at Eylesbarrow and was built between *c.* 1815 and *c.* 1831. The engine wheel-house is marked on the Plan of Ellisborough Tin Mine, though unfortunately no details of the wheel are supplied. (WDRO WW21)

It is not certain how closely the wheel would have fit into the pit; a margin of 10cms at each side of the pit may have been sufficient to accomodate a wheel with 2ft (0.60m) breast. A margin of 15cms would permit a wheel with 1ft 8inches (0.50m) breast. An engine wheel under 2ft breast may have been unusual; in Barton's list of 160 engine wheels documented in Cornwall and Devon between 1811 and 1856, only six out of 141 recorded breadths were under 2ft. (1968, 168-173) However, these demonstrate that narrow wheels were not unknown; for example a 32ft diameter wheel was 1ft 10inches abreast, and a 30ft wheel was 1ft 8inches abreast. (*ibid.*)

The length of the axle is more certain. An axle cannot project beyond the cranks at either end, as it would interfere with the action of the sweep rods. Therefore the axle must have been less than 2.86m (9ft 4inches). This is the distance between the first two sets of granite stanchions, indicating the position of the two flat rods, which must equal the distance between the two sweep rods at each end of the axle. (see below p.454)

Fig. 5:21 The engine wheel-house, Mon 1097

Plate 5:2 Engine wheel-house, **Mon 1097**

Plate 5:3 Wheel-pit, **Mon 1111**

The diameter of the wheel may also be tentatively calculated. The axle must have rested at a sufficient height above the edge of the wheel pit to allow the crank to revolve freely. Therefore the pit did not need to accommodate the full diameter of the wheel. However it might be assumed that the pit will not be less than the total diameter to allow water to drain into the outflow through the pit. Therefore this pit may have been designed for a wheel 25ft to 27ft in diameter. Robins refers to a 30ft wheel at this site, though no evidence has been found to substantiate this claim. (1984, 126)

This wheel was advertised for sale in September 1844 along with other pumping machinery but it seems to have remained unsold, as it was still on the site in 1847. (MJ 28.9.1844)

ii) **MON 1111**

Greater detail is available from documentary sources about the second major phase of mining at 19th century Eylesbarrow. In 1847 a wheel, 50ft in diameter and 3ft breast, was constructed using the axle from the earlier engine wheel, **Mon 1097**. (MJ 3.7.1847; 9.10.1847) In June 1847, it was estimated that the wheel and wheel-pit would cost £170 and £30 respectively to construct. (MJ 3.7.1847) Deep Adit Shaft, **Mon 1111**, was enlarged to accommodate the wheel. (Plate 5:3) This pit opens out at the top to reach about 35m long by 13m wide, though a wheel "slot" 60ft (18m) by 17ft (5m) was constructed at the bottom. (MJ 30.10.1847) The pit was excavated 50ft deep so that the whole wheel would have been below ground surface. The lower part of the N side is faced with masonry, which is probably the walling referred to in the Mine Captain's report for October 1847: "we are all but in readiness to commence with walling the pit up." (MJ 30.10.1847)

The width of the wheel slot (17ft), allowing a considerable gap on each side of the wheel, may be unusual but occurs because the pit was a modified shaft rather than a custom-built wheel house. However, greater width would also be required to accommodate the crank and sweep rods below ground level. It might be suggested that the wheel was erected relatively close to the N side of the pit and that the N end of the axle rested on a granite support at the top of the masonry. The crank and sweep rod was probably attached to the S side of the wheel; the line of granite stanchions of the flat rod system, **Mon 1114a** (described below), leads to the S side of the pit. As pointed out above, the axle cannot have projected beyond the crank. Therefore the S end of the axle must have been supported on a frame built within the pit. The Captain's remark that "we have necessary timber here to do most of the work, with the exception of a long piece of balk [squared timber] - or it may require two - for the wheelpit", could be connected with such a framework. (MJ 30.10.1847)

iii) **MON 1200**

The function of the wheel-house at Wheal Katherine is not clear. In the absence of any evidence for stamping or smelting, it might be assumed that this wheel, situated in the vicinity of several shafts, was intended for pumping. However, neither is there any evidence of a flat-rod system, connecting it to a shaft. A greater difficulty is the almost complete lack of a water supply; water in the R Plym is extremely limited at this high elevation. Possibly the wheel-pit was never used because of this insurmountable problem, a theory supported by the good state of preservation.

The wheel-house (illustrated in John Robins' Follow The Leat. (1984, 138)) consists of a well-built stone-lined slot, constructed of large granite blocks, and measuring 6.70m by 1.15m. It is suitable for a wheel 20ft to 21ft (6.10m to 6.40m) in diameter and 2ft 9inches to 3ft 1inch (0.85m to 0.95m) abreast. It is not known when this wheel-house was built; it is not marked on 19th century plans of Eylesbarrow Mine, though other workings in the area such as Frank's Shaft, **Mon 1199** and the stamping mill, **Mon 1185**, were recorded. (WDRO WW21 and 20a)

Details of water supply and power transmission are discussed below, but it may be appropriate here to point out that all three engine wheels seem to have been of the overshot or possibly pitchback variety, in which water supply was directed by a wooden launder to the top of the wheel. Documentary evidence indicates that the 50ft wheel, **Mon 1111**, was overshot; during the 1847 construction work, the Mine Captain reported that "the launders are completed to carry the water over the wheel". (MJ 30.10.1847) The earthen embankment, on which a wooden launder would have conveyed the water supply to the top of the wheel, **Mon 1097**, is still visible. A similar arrangement may have existed on the higher ground above **Mon 1200**, though the course of a leat here has not been traced.

An overshot wheel was most efficient where a great quantity of water may not have been available, but where a head of water could be obtained, so that "the weight of the water was added to the power of the moving stream". (Barton 1968, 158) It was found to give several times the power of an undershot wheel of the same size. (*ibid.*) The most efficient way to introduce the water was in a shallow leat about the same width as the wheel "to approximate the water flow to the bucket capacity of the wheel and its rate of revolutions per minute". (*ibid.*) A circumferential speed of about 210ft per minute was effective for wheels up to 20ft in diameter (ie. 3.34 rpm). A speed of about 400ft was preferable for wheels over 30ft in diameter, which produced about 4rpm and thus four strokes of the pumping rods - "a speed well suited to most mine pumping." (*ibid.*)

The exposed location of the UPV engine wheels may have led to a loss of water and thus power in strong winds. It is even possible that "a big wheel on an exposed site could be brought to a standstill by a gale from certain quarters." (Barton 1968, 182) Thus some form of shelter may have been provided. **Mon 1200** is at present completely open to the elements, while the walls around **Mon 1097** would not have provided much cover; these, currently 1.20m high are "probably not much less than their original height." (Cook *et al* 1974, 179) However, a wooden or even tarpaulin windbreak could have been erected. According to a visitor to Wheal Friendship at Mary Tavy in the 1840's: "A shed protects the wheel from the storms of winter, or other injury." (quoted in Robins 1984, 157) The 50ft wheel, **Mon 1111**, sunk completely into a pit would have been well-protected from the wind, an advantage acknowledged by the mine captains: "our new 50-feet wheel will be completely sheltered from the severity of the weather - no frost or snow will take any effect on it." (<u>MJ</u> 31.7.1847)

Early wheels were entirely of wood but were gradually replaced by composite wheels of wood and iron. (Barton 1968, 165) Smeaton introduced cast-iron axles and cranks, which became common after 1800 and iron could also be used for segments of the rim and for curved buckets. (*ibid.*) Wheels were often built by local companies, such as Nicholls, Williams and Co. of Tavistock. (Wellington 1985, 7; Barton 1968, 188) Contemporary accounts indicate that the UPV 50ft wheel, **Mon 1111**, was of wood and iron, assembled *in situ*. Thus the Mine Captain reported in October 1847 that:

> "the smiths have been working by day and night, to finish some portion of the ironwork, for the carpenters to get on with the wheel ... we have ... cut all the timber and completed the wheel, such as buckets, arms etc. etc. so far as it is possible to go before the axle is in its place." (MJ 30.10.1847)

Brass was introduced in the 18th century for bearings or "collars". (Barton 1968, 162-5) The "brasses" noted as an adjunct to the wheel in the 1852 sale advertisement may have been for the axle bearing. (MJ 25.9.1852)

d) Water Supply

The success of the wheel and pumps depended essentially on the water supply and considerable efforts were sometimes made to secure a reliable supply. The planning and implications of Dartmoor leats are discussed below. (section 5.10)

i) **MON 1097**

In UPV, the most impressive example is the leat, which fed the engine wheel, **Mon 1097**, as well as six stamping mills and a blowing house. The Engine Leat, **Mon 1075**,(described in detail in Appendix F) conveyed water from Upper Langcombe Brook to a reservoir, **Mon 1100**, covering a total distance of 4520m (2.81 miles).

The threat to open leats of drought and freezing are discussed below. (See pp.541-3) While these two extremes were probably unlikely, the supply could still have fluctuated between them. For example, at Wheal Sidney, near Plympton in 1859, the increased revolutions of the 45ft wheel (and therefore increased strokes of the pump) in winter (5 rpms) in contrast to summer (3 rpms), was probably made possible by increased water supply. (Barton 1968, 185-6) The construction of a reservoir, such as **Mon 1100**, would have helped to regulate the water supply.

It is difficult to calculate how much water could have been collected by this leat. Presumably a certain amount would be lost in transit. However, the maximum capacity of the reservoir of 2.88 million litres (633,600 gallons) is a considerable amount. Known locally as "Lake", it must have been a significant pond in the 19th century for the claim to be made that the mine owner liked "to entertain his friends with a little boating." (Breton 1911, 4) Even recently it has been observed by Hemery almost filled with water after heavy rain. (Hemery 1983, 190) However, in 1847 it may have been considered to be insufficient for a 50ft wheel, to such an extent that it was worth constructing a new pit further downhill and consequently a new flat rod system.

ii) **MON 1111**

In June 1847, Capt John Spargo considered the steps necessary for the revival of Eylesbarrow Mine and concluded that:

> "It will be necessary to remove the engine wheel from where it now is, to the tail of Two Brothers' adit, where we shall have a sufficient supply of water to work a wheel 50ft diameter." (MJ 3.7.1847)

It is hard to believe that a greater supply of water and without the benefit of a reservoir, could be obtained from Two Brothers' Adit, than from the Engine Leat. Possibly part of the problem lay in finding a suitable location for an overshot 50ft wheel. Engine wheel-house, **Mon 1097**, would have had to have been completely demolished and a much larger pit excavated to allow the Engine Leat to overshoot a 50ft wheel. Thus an old shaft probably presented a simpler alternative.

A significant stream today issues out of the adit mouth, **Mon 1112**. In 1847, this tailrace must have been diverted through an underground channel to the wheel-pit. It may have emerged at the stone-lined opening, visible about 3m below ground surface at the E end of the pit. (See Plate 5:3) A platform immediately in front of the stone work could have supported one end of a wooden launder. Contemporary reports suggest that this was not the only supply. On 29th July 1847, Capts. Gregory and Spargo reported that "we have also commenced cutting a new piece of leat, so as to bring another never-failing stream of water over the wheel." (MJ 31.7.1847) This may be the NW extension of the Stamping Mill Leat, **Mon 1052**, recorded by Cook, Greeves and Kilvington. (1974, 181)

iii) **MON 1200**

No evidence of a leat to the wheel-house, **Mon 1200**, has been traced. A leat could have been directed onto the higher ground above the NE end of the wheel-pit but, as noted above, the water supply at this elevation is very limited.

Provision had to be made in each wheel-pit for the outflow. The arrangement in **Mon 1200** is the best preserved; a tunnel leads out of the SW end and turns sharply to the SE, before issuing out into the steamwork below. The outflow in wheel-house, **Mon 1097**, is masked by rubble fill in the wheel-pit. However, the tail race emerges from an underground channel at the W end of the whole structure and this may be connected below the bob-pit to the W end of the wheel-pit. (see Fig. 5:21) The outflow in **Mon 1111** was said to be through Deacon's Adit. (MJ 9.10.1847)

e) Transmission of Power

In order to transmit the power of the wheel to the pump, the circular motion of the wheel is converted to reciprocating motion by a crank attached to the axis of the wheel. Power depends on the diameter of the wheel and on the reach of the crank. If the wheel was erected directly at the shaft, pump rods could be attached to the crank.

However, as the location of the wheel was dictated by available water supply, the wheel often had to be erected downhill from the shaft head and thus it was necessary to transmit power for some distance. Furthermore, as Barton points out, it may have been preferable to site the water wheel at least a short distance from the shaft to avoid any chance of a flood from the leat into the workings. (1968, 160) Thus a crank arm or "sweep rod" connected to the crank carried the motion to a system of connecting rods. Known as "flat rods", these could be square or round in section as well as rectangular or "flat" and were jointed together to form a single straight rod. (see Fig. 5.22) Such a system may date to the late 17th. Century. (RN Worth 1872, 24) Wooden rods were thought to withstand better the alternate compression and tension, though wrought iron could also be used. (Michell and Letcher 1876, 138; Barton 1968, 160)

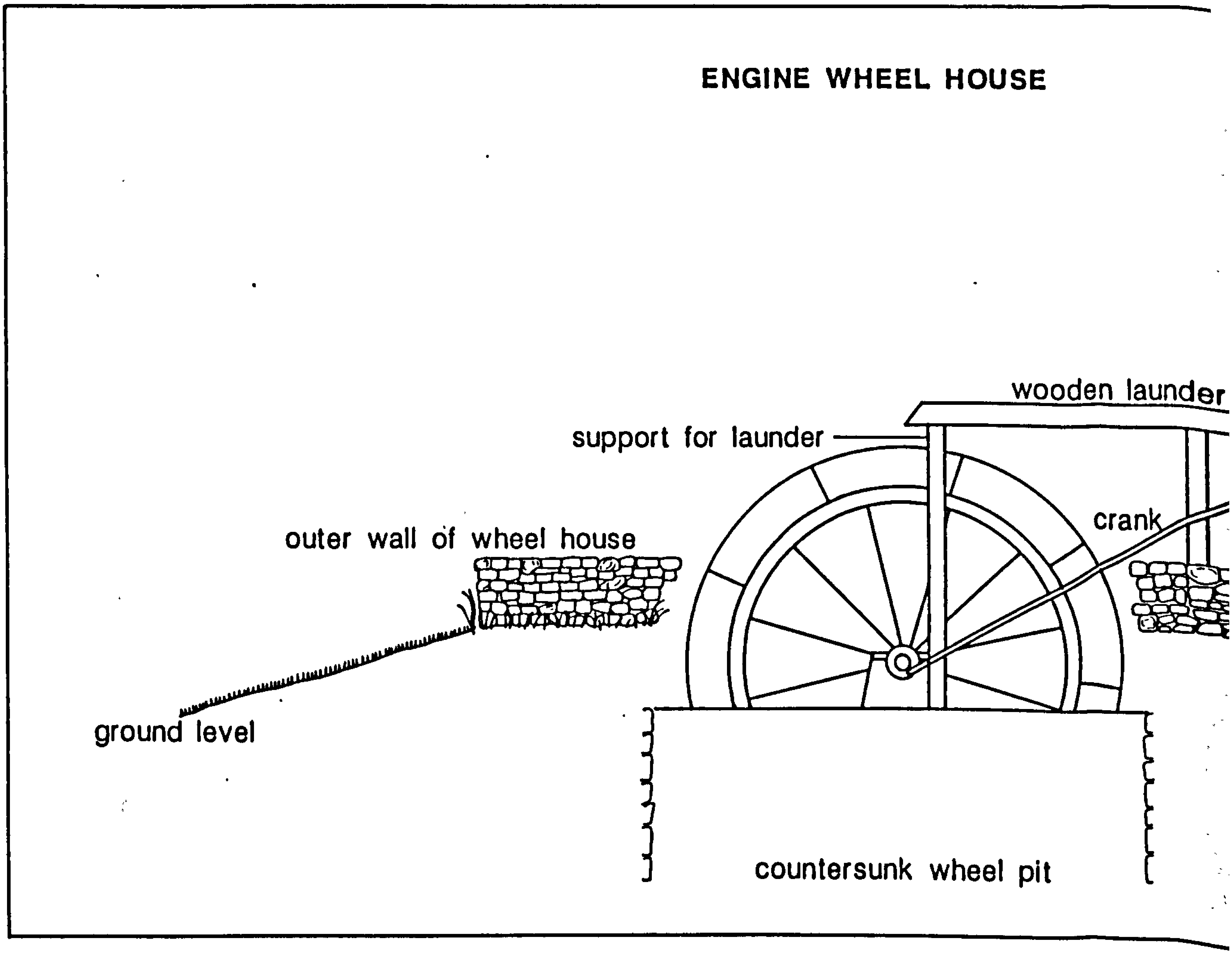
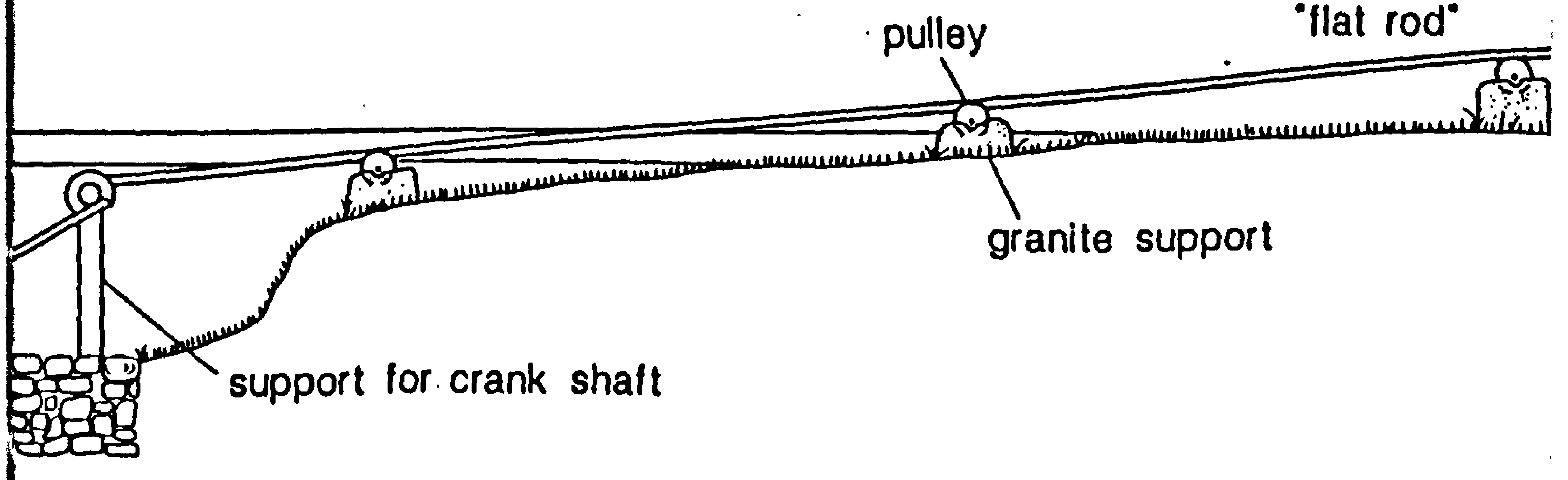


Fig. 5:22 A reconstruction of the engine-wheel and flat rod system

FLAT ROD SYSTEM



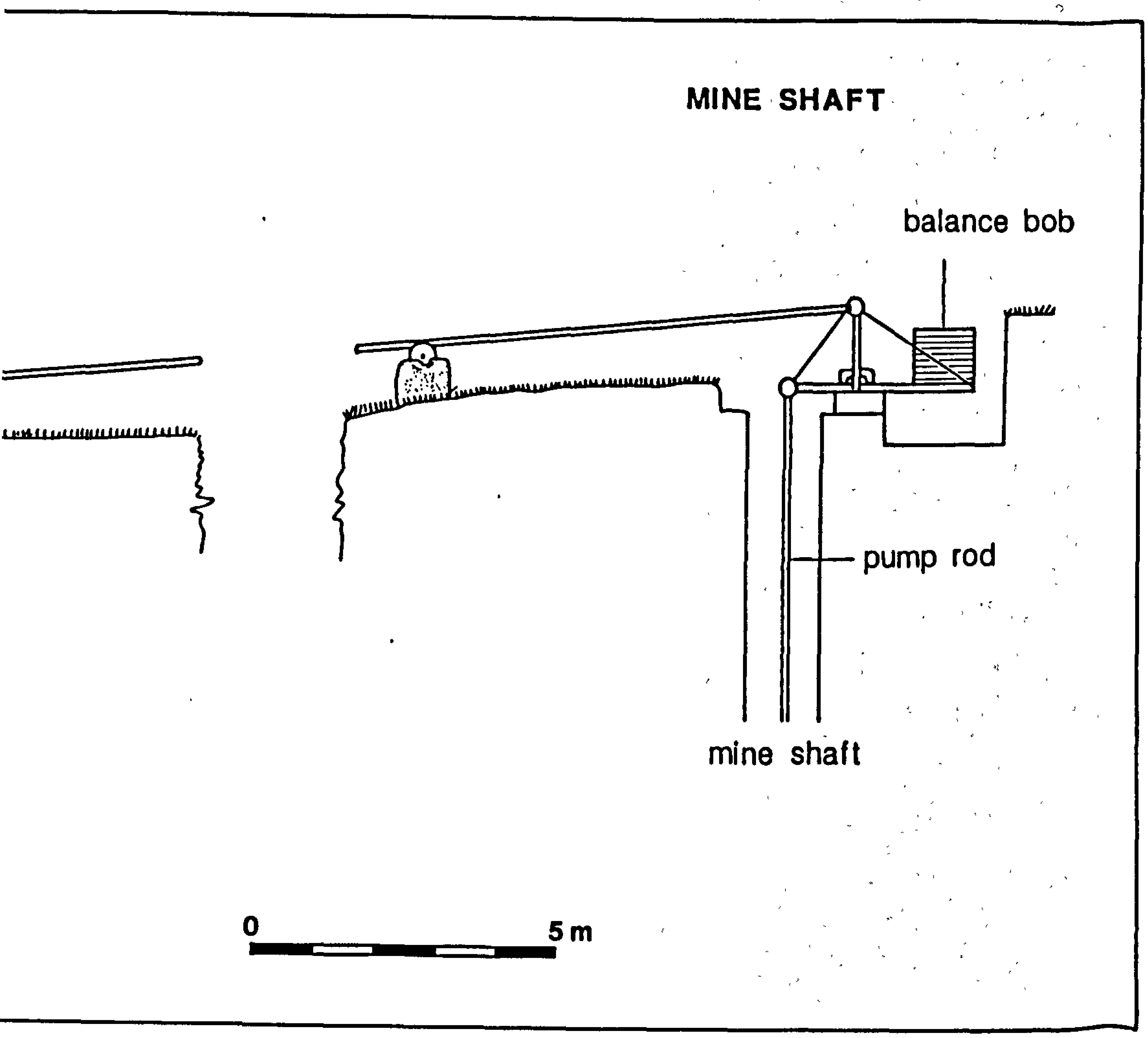

MINE SHAFT
balance bob
pump rod
mine shaft
0
5 m

Plate 5:4 Granite supports for the flat rod system, **Mon 1103a**

In UPV, evidence survives of two separate flat rod systems, **Mon 1103** and **Mon 1114** powered by engine wheels, **Mon 1097** and **Mon 1111** respectively. In both these systems, the jointed rod oscillated on iron sheaves or pulleys, probably double-flanged and the axle of each pulley rotated in grooves cut into the upper face of granite stanchions. Pairs of these grooved granite supports are all that remain in the archaeological record. (See Plate 5:4) Each pair consists of two long upright stones set parallel about 0.20m apart, aligned along the orientation of the power line. The pairs are spaced fairly regularly at a distance of 6m to 8m. Some are edge-set slabs up to 0.50m high, but others are almost at ground level, identifiable only by the grooves.

This may have been to compensate, as Cook, Greeves and Kilvington suggest (1974, 180), for local changes in elevation, to allow as even a course as possible. The same writers also observed worn arcs, possibly made by misaligned pulleys, on the inner faces of two sets of stanchions, and black streaks around some of the grooves, presumably remains of a lubricant, which they suggest may be the gas tar included in the 1852 advertisement for the sale of equipment. (Cook *et al* 1974, 182)

Documentary evidence supplies more detail. "Horizontal rods" were included in an advertisement for the sale of equipment in 1844, but like the engine wheel, they may not have been sold. (MJ 8.9.1844) Rods and other items "used by the late proprietors" were said to be available in 1847. (MJ 21.8.1847) Therefore the rods included in the 1852 sale may have been in use throughout the 19th century operations at Eylesbarrow, in **Mons 1103** and **1114**. Although wood may have been generally preferred for "permanent use and for moderately large work" (Michell and Letcher 1876, 138), iron rods were used at Eylesbarrow and advertised for sale in 1852:

> "143 fms. iron rods 2 1/4 inches wide by 2 3/4 inches thick, with joints, pins etc.,complete;
> 153 fms. iron rods, 1 3/4 in. square, with joints, pins,etc., complete;
> 342 fms. of round iron rods, from 1 1/4 in. to 1 1/2 in., with pins, joints, etc." (MJ 25.9.1852)

These may all have been horizontal rods, as "bucket rods" which must represent the vertical element are listed separately. The total length (1167.52m) is just enough to cover the maximum distance of the Eylesbarrow flat rod system, **Mon 1114a** and **b**, of 1146m. (See below p.455) It is not clear if these rectangular, square and round rods had specific functions; they may have been completely interchangeable. Pullies were also for sale in 1852. (*ibid.*) The "139 cast iron pullies of 17 inch diameter, nearly new" may have been acquired for the 1847 revival, and thus **Mon 1114**. The " 40 ditto of 20 inch diameter" may have been originally part of **Mon 1103**. It is not clear if the diameter of the pulley is significant.

i) **MON 1103**

Engine wheel, **Mon 1097**, powered two lines of flat rods, which may have been able to operate simultaneously. The first pair of stanchions of each line, lying 2.86m apart, is visible in Fig. 5:21. The S line, **Mon 1103c**, may have operated a pump in Barrack Shaft, **Mon 1140**, 355m from the engine wheel house, in Philp Shaft, **Mon X23**, 485m from the wheel and in Old Engine Shaft, **Mon 1148** at a distance of 620m. Only five pairs of stanchions and a single stone survive along this line. Stanchions may have been removed for reuse in the 1847 flat rod system, **Mon 1114**. If supports are set at an average distance of 7m apart, a total of 88 pairs and therefore pullies may have been required.

Two phases of construction are evident in the N line, **Mons 1103a** and b. Two pairs of supports are visible, side by side, near shaft, **Mon 1131**, though mostly the supports of each phase are placed alternately. The N phase, **Mon 1103a**, seems to lead to Hawks Shaft, **Mon 1132**, at a distance of 235m from the engine wheel-house, though no stanchions are visible on this line for the final 55m. 17 pairs of stones survive, though there may have been originally 33. Possibly this N phase was of an early date and was partly dismantled and replaced by the S phase, **Mon 1103b**, which bypasses Hawks Shaft. 24 pairs of stones are visible in **Mon 1103b** but its ultimate destination is uncertain; no stanchions are visible E of the enclosure wall, **Mon 1134c** around the account house, which might suggest that the line was disrupted by refurbishment of mine buildings. However, it is also possible that, as noted above, this line was intended to reach Henry's Engine Shaft, **Mon 1153**, but that the engine wheel was moved to a new location before its completion.

ii) **MON 1114**

Removal of the engine wheel to Deep Adit Shaft, required power to be transmitted over a much longer distance and the flat rod system from engine wheel, **Mon 1111**, to the shaft, **Mon 1166**, covered a total distance of 1146m. European examples were often over 1km long and one rod drive 3.5km in length, was constructed at Norberg, Sweden in 1870. (den Ouden 1981, 9-10) Cornish flat rod systems were usually only up to 1/4 mile (402m) in length (Barton 1968, 160), though longer systems may have been more common in the W Devon mining area, noted in the mid-19th century for its large water wheels. Thus at Devon Great Consols in 1849 a line of wrought iron flat rods, 3 1/4inches thick, running on pulleys fixed on wooden supports, transmitted power from a 40ft by 12ft wheel for 724.68m to Wheal Maria and 658.8m to Wheal Josiah. (Booker 1967, 150) However, this is still some way short of the distance covered by **Mon 1114a** and b.

Documentary evidence suggests that it may have been considered to be a long system at the time. The Mine Captain's report in October 1847 refers to the work of the smiths on the horizontal rods: "here they have a deal to do, to complete such a long run of them." (MJ 20.10.1847) As horizontal rods were already available, the smith's work may have involved joining them together into a single rod.

A single line of rods, **Mon 1114a**, was connected to engine wheel, **Mon 1111**, and may have operated pumps in Henry's Engine Shaft, **Mon 1153** and Pryce Deacon's Shaft, **Mon 1154**, at a distance of 842m and 965m respectively from the wheel. 64 pairs of supports were traced on this line, though large gaps particularly at the W end in an otherwise regularly-spaced series suggests that this is considerably less than the total number. It is also possible that granite stanchions were not used at the W end. The report on the construction of the wheel-pit, notes that the 50ft wheel was to be sheltered from the elements " as well as 25 fathoms (45.8m) of rods, which will be underneath". (MJ 31.7.1847) This suggests that the flat-rods were directed, from the crank, underground through the side of the pit, possibly at another piece of stonework below the leat outflow. (see Plate 5:3) It may have emerged after 14m and continued below surface level in the gully, **Mon 1113**. The first granite stanchions are situated 66m from the inner side of the pit and an alternative support may have been more appropriate in such an arrangement. The rod could be mounted on vertical rocking levers, or could be suspended from an A-frame, or could roll on iron sheave wheels carried on a wooden trestle such as at Wherry Mine, Penzance, in the 1790's and 1830's. (Barton 1965, 98) Two iron rings set in granite near the E edge of the pit may be associated with the system. Extrapolation suggests that a total of 138 supports ran between the wheel and Pryce Deacon's Shaft. Some of the deficit may remain *in situ*, masked by dense heather cover, but others may have been removed.

711m from the wheel pit, a branch line, **Mon 1114b**, runs to the NE to **Mon 1066**, a distance of 455m from the junction. 56 pairs of stanchions are visible, out of a possible original 65. The number of pullies advertised for sale in 1852 suggest that a maximum number of 179 supports were in use. (MJ 25.9.1847) Extrapolation of the archaeological evidence suggests that a total of 203 was required for **Mon 1114a** and **b**. However, the supports may not necessarily have been spaced evenly at an average of 7m so that a smaller number of pullies may have been sufficient, and some may, of course, have been lost.

iii) **MON 1200**

No archaeological evidence has been found of a flat rod system connected to wheel-pit, **Mon 1200**. Possibly flat rods were supported by a different method, the remains of which were subsequently removed as it is perhaps unlikely that all evidence of a granite stanchion system would have been removed. However, as suggested above, the wheel may not have been completed because of lack of water.

iv) Changing direction (Angle-bobs)

At the shaft-head, the direction of stroke had to be converted from the horizontal to the vertical."The usual solution is to apply a triangle." (den Ouden 1981, 19) Thus a right-angled angle- or bell-crank ("angle-bob") connected the horizontal flatrods to the vertical pump-rods. (See Fig. 5.22)

Occasionally a change of direction in the pump-rod might be required. In this situation, an angle-bob (called a V-bob when the angle is acute) was the most frequently used solution. (Barton 1965, 94 Fig) It is more efficient than other methods using wheels and chains, though it could be costly to install; a niche has to be excavated to accommodate it. Presumably, in a bucket-lift system, a V-bob could only be used above adit (and therefore pump) level.

The direction of the horizontal rod could also be changed, as occurs in **Mon 1114**. At a point 711m from the engine-wheel, a branch line, **Mon 1114b**, runs to **Mon 1166** at an angle of 58°. (See Sheet 31) To allow a change of direction an angle-bob could be mounted horizontally, with the arms attached to flanged wheels running on a circular rail or flat rods could be connected to a wheel turning on a vertical axle, for example at Ludvika, Sweden. (den Ouden 1981, 17-18) (See Fig. 5.23) The latter system is probably only balanced when two parallel rods are in operation and is therefore unlikely to have been used in **Mon 1114**.

Alternatively an angle-bob (or specifically a V-bob) could be mounted on a vertical axle supported by ropes or iron stays, but without the support of wheels at the outer edge of the arms. (den Ouden 1981, 18) (See Fig.5:24a) This would put an extra load on the bob, but it would mean that by fixing a second bob to the first bob (above or below it, but on a different alignment), the direction of the original rod could be continued as well. (See Fig.5:24b) Thus the branch line and the main line could work simultaneously.

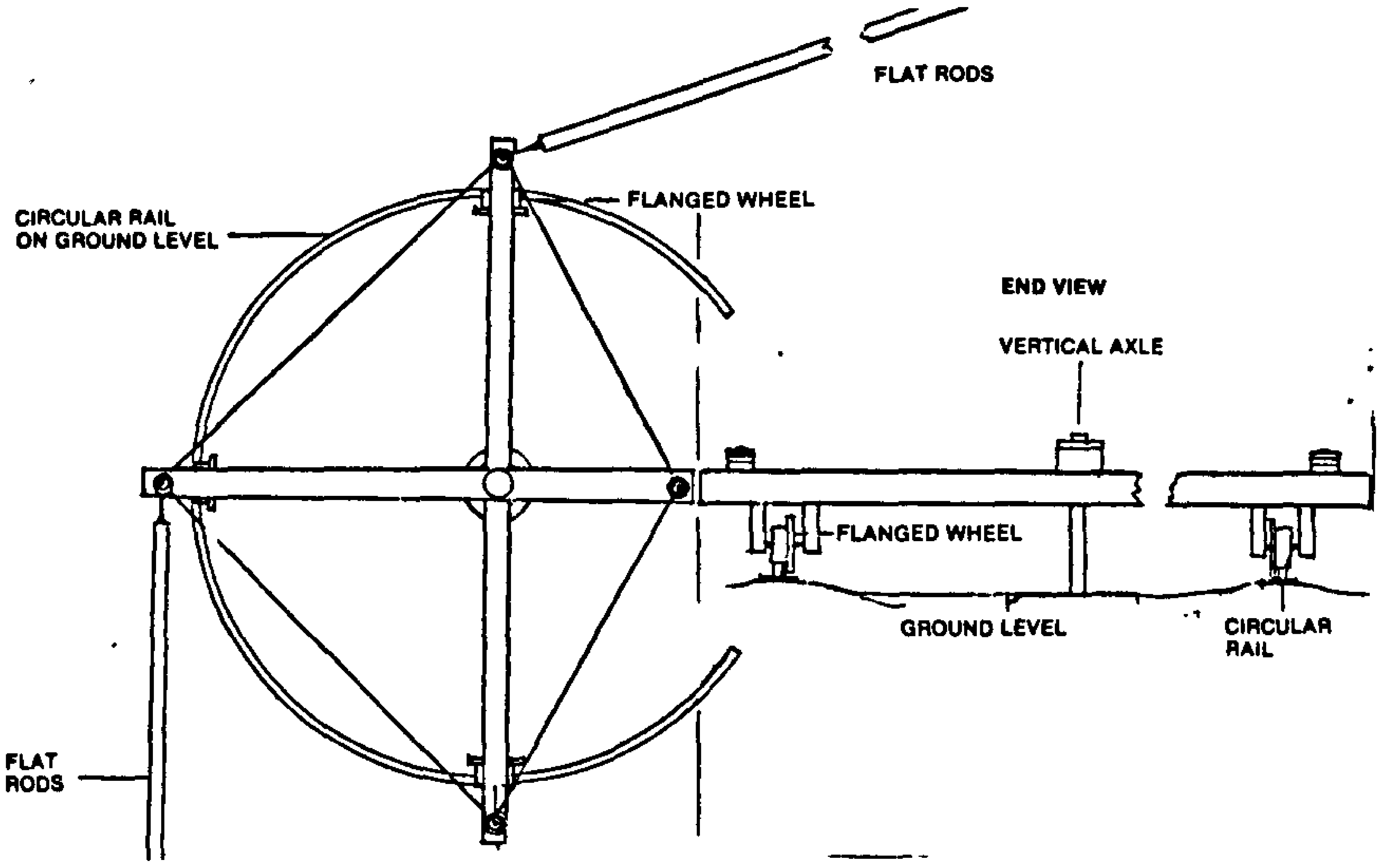


Fig.5:23a The angle-bob on rails
(from Wellington 1985,17)

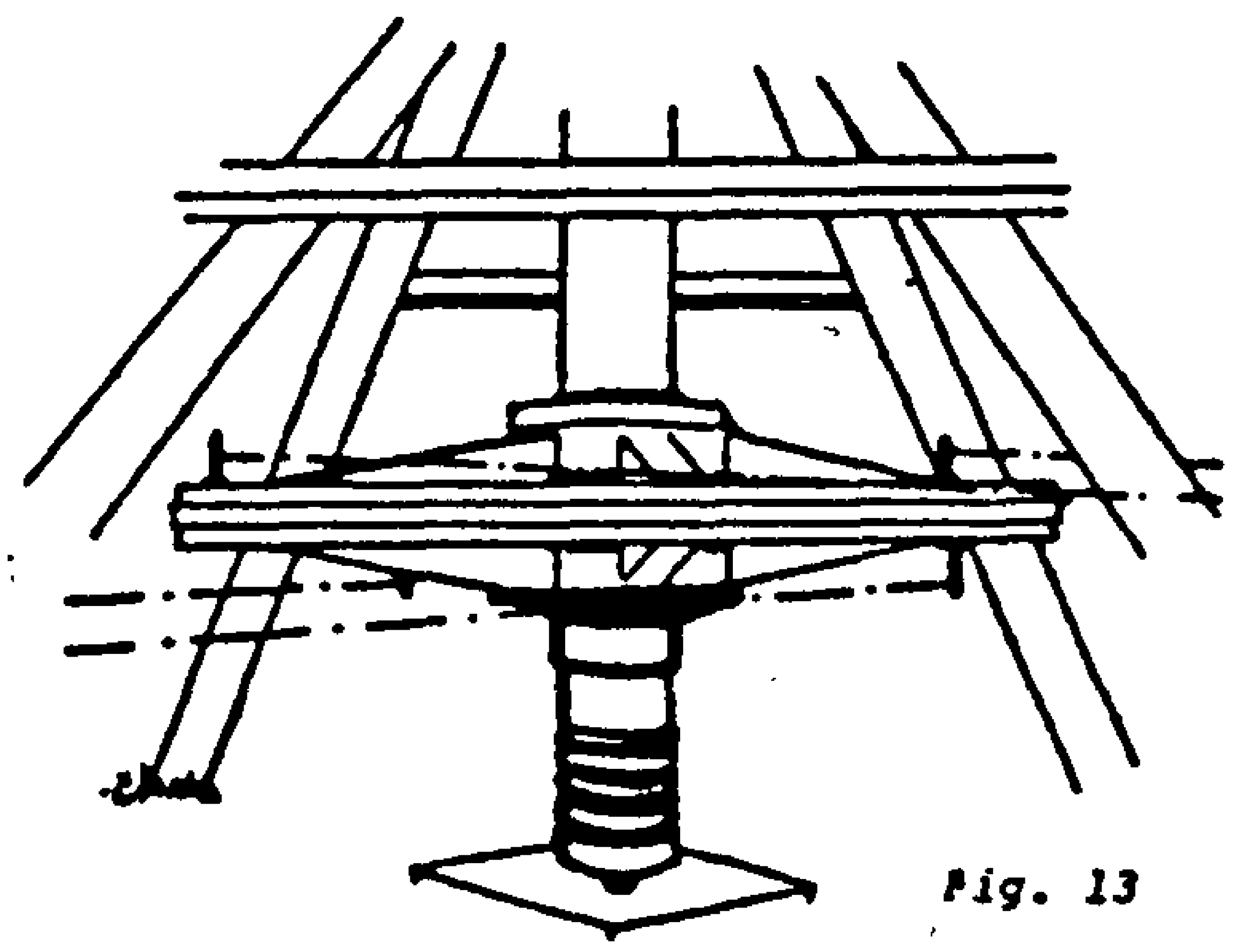


Fig.5.23b The angle-bob on a wheel
(from den Ouden 1981, 17)

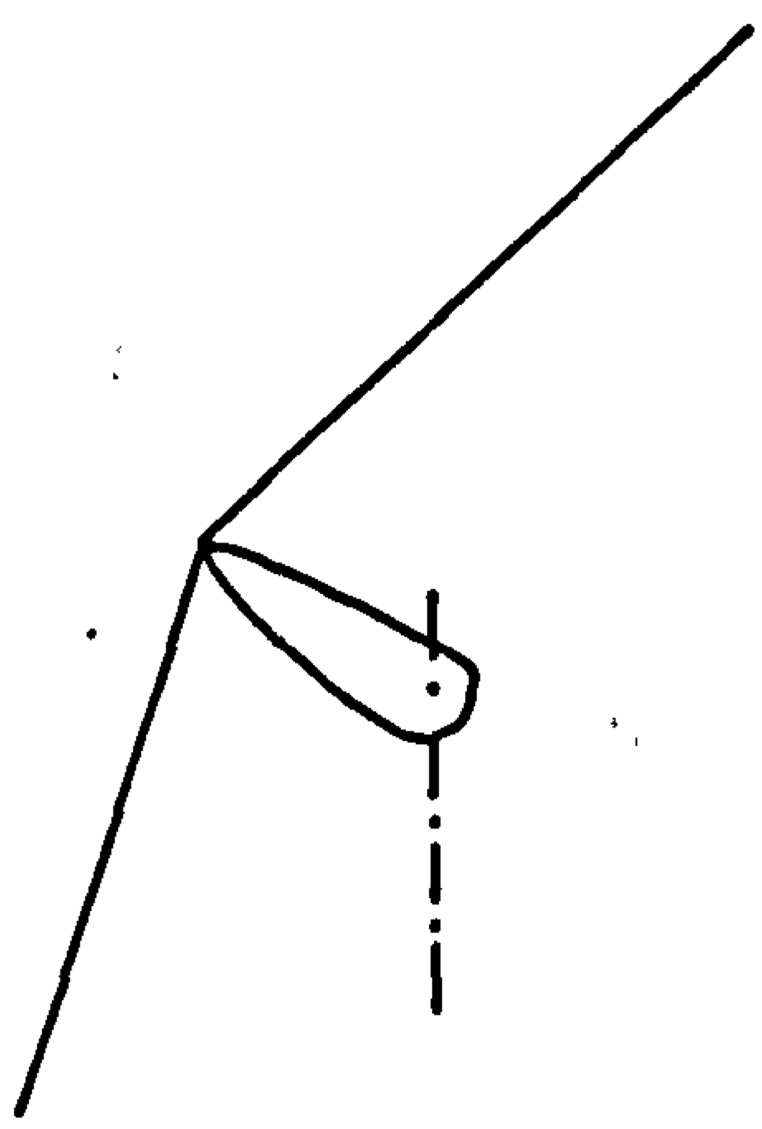


Fig.5:24a

The angle-bob on
a vertical support

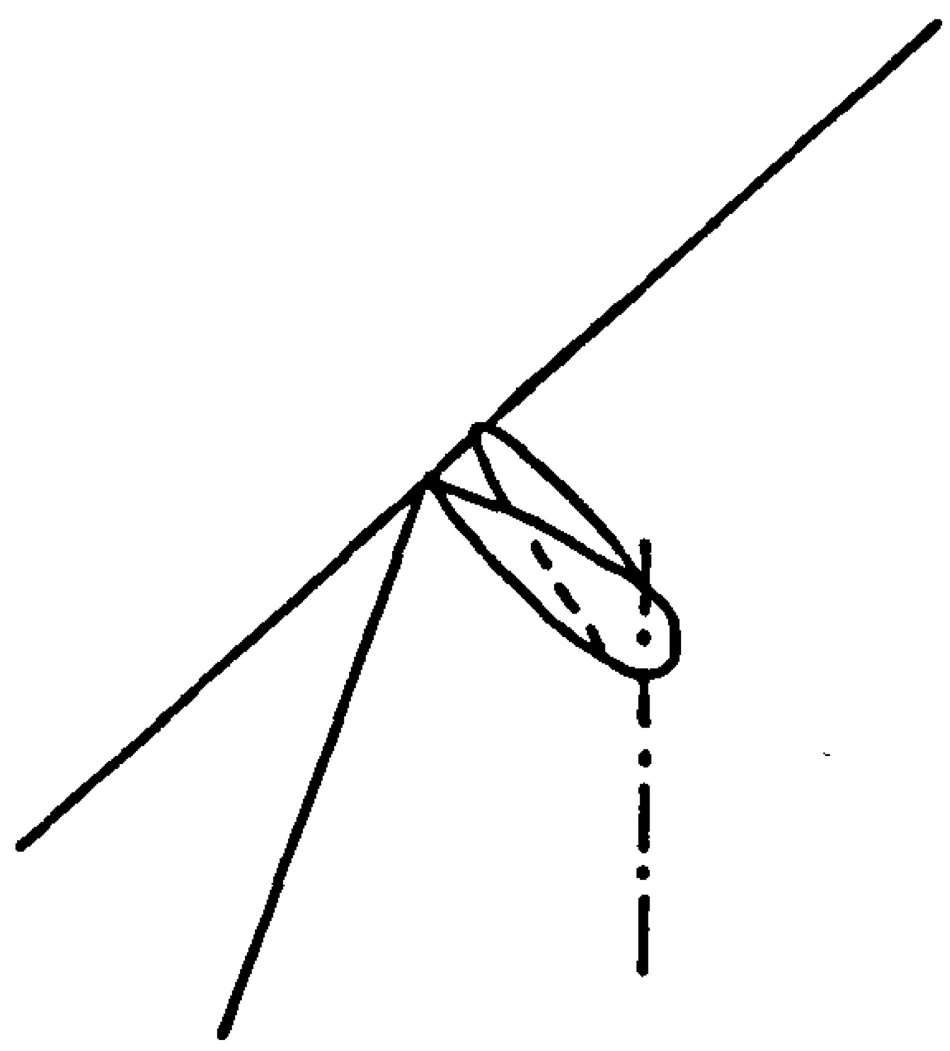


Fig.5:24b

The angle-bob on a vertical
support, allowing two branches to
operate simultaneously

Absence of evidence for a circular rail suggests that a V-bob, may have been used, in which case a double-bob arrangement allowing simultaneous working of **Mons 1114a** and **b** cannot be ruled out. However the sale in 1852 of only a single bob ("1 V bob with axle, iron stays, sweeps and rools to match." (MJ 25.9.1852)) suggests that this is unlikely. It is worth noting that all changes of direction reduced efficiency significantly and presumably were kept to a minimum.

v) Balance-Bobs Maximum efficiency requires a balanced system. In order to achieve this, balance-bobs also called balance-beams, were attached to different components of the pumping system. These were usually boxes filled with stones or scrap iron, which could then be altered in weight, fixed on one end of a timber or iron beam. (Michell and Letcher 1876, 204; Wellington 1985, 10) (See Fig.5.22) Their former use can be detected by the presence of a square or rectangular pit, which would have accommodated the bob on its downward swing. The main aims were to balance the wheel and to maintain tension in the horizontal rod. If a wheel is connected to a single rod driving a single-action pump (eg. a bucket-lift working only on the upstroke), all the work of the wheel is done on only half a revolution. This causes the wheel to turn at an irregular speed and thus reduces efficiency and increases wear. Furthermore acceleration of the wheel during the "idle" half-revolution would tend to push the rods, which could cause them to buckle. (den Ouden 1981, 10-12) It might be assumed that a wheel driving two rods, working on alternate strokes, would automatically achieve balance. However, it should be remembered that the balance maintained by two rods would immediately be upset if one rod worked a heavier load.

These problems could be counteracted by placing a balance-bob behind the wheel or at the shaft-head, or sometimes in both places. A balance-bob attached behind the wheel by connecting rods would load the wheel at the downstroke of the pump, thereby balancing the total weight on the wheel, as well as assist the wheel on the upstroke. The weight of the pump could help to pull the rod on the downstroke, thereby maintaining tension, but a balance-bob attached to the angle-bob at the shaft-head could increase this force. (*op.cit.*, 10)

The UPV evidence for balance-bobs consists of five pits.

1. A masonry-lined pit, almost square in plan (4.55m E-W X 4.20m N-S) lies W of engine wheel-house, **Mon 1097**, ie. on the opposite side of the wheel from the flat rod systems. (See Fig. 5:21) A gap at the N end of the E side of the pit may be an original opening, which matches a gap in the W end of the wheel-house wall. This opening could have allowed the passage of connecting rods from a crank attached to the N end of the axle. A grooved stone, at the S end of the gap through the wheel-house wall may be associated with the line of rods.

2. A well-preserved masonry-lined pit, rectangular in plan (3m X 2m) is situated W of Henry's Engine Shaft, **Mon 1153**. It is on the same side of the shaft head as the flat rod system and is directly aligned with it.

3. A dilapidated pit, also rectangular in plan, but with little stone-lining remaining, is situated W of Pryce Deacon's Shaft, **Mon 1154**. It is also on the same side of the shaft-head as the flat rod system and is directly aligned with it.

4. The depression on the E side of Old Engine Shaft, **Mon 1148**, partly bounded by a low overgrown wall, may have been a bob-pit. It is on the opposite side of the shaft from the flat rod system.

5. A pit on the N side of **Mon 1166**, also on the opposite side of the shaft from the flat rod system. may have been a bob-pit.

6. Cook, Greeves and Kilvington recorded a bob-pit at Whitford's Shaft but, as noted above (p.430), this shaft and bob-pit is more likely to be Henry's Engine Shaft.

The position of the bob-pit in a pumping system indicates to which component the balance was attached, and furthermore the position at the shaft-head indicates the position of the angle-bob, which, in turn, may suggest the type of pump in use. The balance-bob behind wheel, **Mon 1097**, may have been sufficient to balance the pumping systems to shafts, **Mons 1132** and **1140**, which have no trace of bob-pits at the shaft-head. However, an extra balance-bob may have been necessary at Old Engine Shaft, **Mon 1148**, to compensate for the much greater length of flat rods.

In the system driven by wheel, **Mon 1111**, balance-bobs were placed at the shaft-head. There is no evidence of a bob-pit at the wheel, though the large wheel-pit might have accommodated a balance-bob, without digging an extra pit.

A balance at the shaft-head is normally attached to the angle-bob. In Henry's Engine Shaft, **Mon 1153** and Pryce Deacon's Shaft, **Mon 1154**, the angle-bob with balance is situated at the end of the horizontal rod before the shaft. (See Fig. 5.25a) When the horizontal rod is pulled by the wheel, the pump rods are lifted. Therefore this is a bucket-lift, working on the upstroke. In this case the balance-box assists the wheel on the upstroke. The weight of the pump may have been sufficient to maintain tension in the rods on the downstroke.

By contrast, an angle-bob on the far side of the shaft would lower the pump-rod when the horizontal rods are pulled by the wheel. (See Fig. 5:25b) As the work of the wheel must be done when it is pulling the rods, this can only be a pump working on the downstroke, ie. a plunger pump. In this case the balance-bob would balance the weight of the plunger-pole when it is raised, as well as maintain tension in the horizontal rods. (Barton 1968, 161) Therefore if the pits to the N of **Mon 1166** and to the E of **Mon 1148** are bob-pits, it is possible that a plunger-pump operated in these shafts.

Few details of the performance of the Eylesbarrow pumping systems are available. Comparison with other Devon wheels may be instructive. At Devon Great Consols, 400 gallons a minute was lifted from a depth of 480ft at Wheal Maria, and 270 gallons a minute was raised from 690ft at Wheal Josiah. These were situated 724.68m and 658.8m respectively from the 40ft by 12ft wheels. (Booker 1967, 150)

The power of a pumping system depends on several factors, only some of which are known for the Eylesbarrow examples. In the 1847 system, the diameter and breadth of the wheel (50ft X 3ft) and the diameter of the pump (8 inches) are known. However, the length of stroke of the pump rod, and the revolutions per minute of the wheel are unknown. Evidence of other wheels suggests that a rate of four strokes a minute (ie 4 rpm) was well-suited to pumps. (Barton 1968, 158)

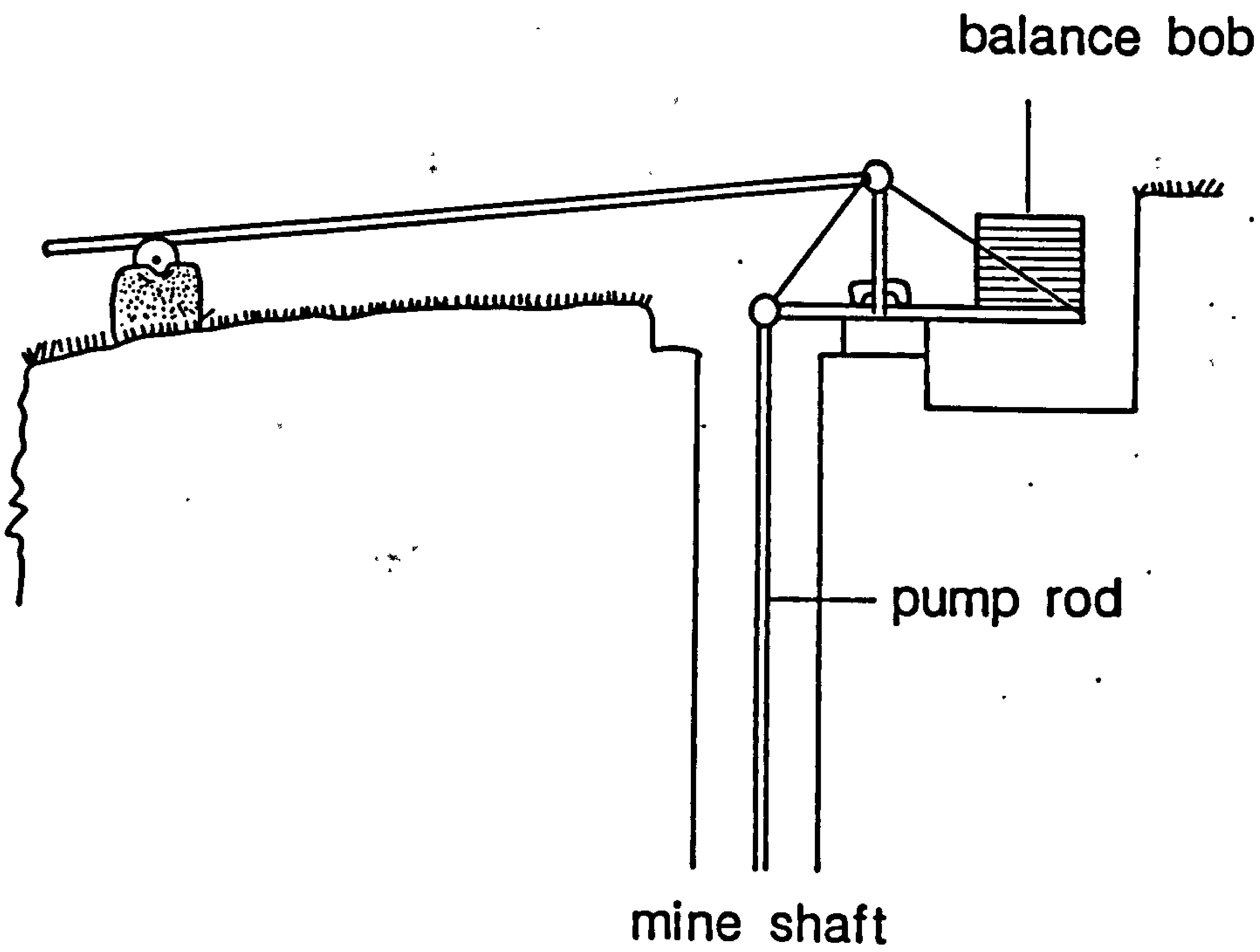


Fig.5:25b The angle-bob in a plunger pump

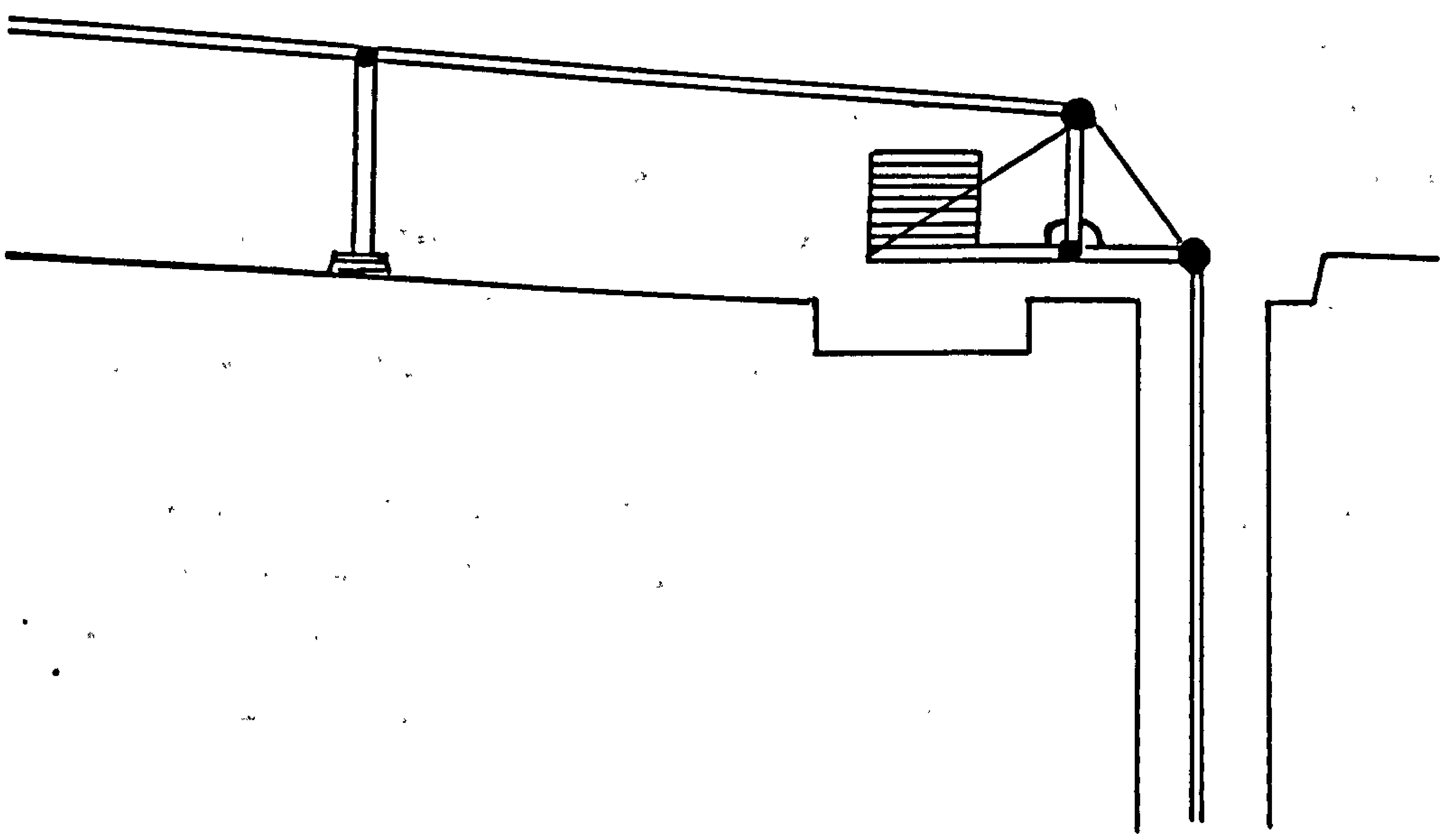


Fig.5:25a The angle-bob in a bucket lift

A 40ft wheel might have a crank stroke of four to five feet. (Wellington 1985, 10) Thus the 40ft by 12ft wheels at Devon Great Consols had a crank stroke of between 42 inches and 48 inches, while the 51ft by 12ft Buller's Wheel at Wheal Friendship had a 6ft stroke. (Booker 1967, 150; Barton 1968, 183) The stroke at the pump was about 20% less than the stroke at the crank. (Barton 1968, 181) If the 50ft wheel in **Mon 1111**, turned at 4 rpm, and the stroke of the pump rod was 4ft, the 8 inch pump in Pryce Deacon's Shaft might have raised 34.79 gallons (158.12 litres) per minute. This is significantly less than the Devon Great Consols pump noted above. Possibly a much bigger pump was used at the latter; pumps could be 6ins - 20ins in diameter "according to the magnitude of the drainage". (Michell and Letcher 1876, 153)

f) Steam Power

Where water supply was adequate, a large water wheel could compete well with early steam engines. For example the 48ft wheel at Cook's Kitchen Mine, Cornwall, at the end of the 18th century, was said to be equivalent to a 47inch Newcomen steam engine. (Pryce 1778, 152; Barton 1968, 156) The water engine certainly compared well in costs, demonstrated in the estimated comparative costs of a water wheel or steam engine to be installed at Higher Rosewarne and Wheal Gerry in Camborne in 1764; although the initial expense of the wheel was only slightly less than that of a steam engine, monthly running costs were considerably lower. (Barton 1968, 153) At Devon Great Consols, the running costs of the steam engines installed in 1847 led to their replacement in 1849 by 40ft water wheels. (Booker 1967, 149)

In UPV a 24 inch double-acting steam engine for stamping with a boiler and 36 heads of stamps was said to be at Wheal Katharine in 1856. (MJ 25.10.1856) However, the absence of any archaeological evidence for this equipment, places the steam engine outside the scope of this survey.

5.6.4 Hoisting, Access and Ventilation

Where possible, raising ore was probably kept to a minimum. Ore could be carried to the surface along an adit, by wheelbarrow or later, by tramming. (Greeves 1981, 158 ; Agricola 1950 ed., 155 ; Greeves 1986, 48 Plate 39)

However, raising ore to the surface or even only to the adit could not always be avoided. The early methods for unwatering, using windlass and kibbles were probably common. At sometime, possibly in the 17th century, the windlass was adapted to horse-power and used both for unwatering and raising ore. The 18th century model consisted of:

> "a perpendicular axis, whereon a large hollow cylinder of timber turns, (called the Cage), round which the rope winds horizontally, being directed down the Mine by two pullies fixed in what are termed Puppet Heads over the mouth of the shaft: this axis has a transverse beam, called the Arm infixed; at the end of which are placed two horses that go round upon a platform named the Whym-round, and draw more or less according to the number of their circumvolutions in any given time, the largeness of the barrels, and the depth the Whym is to draw."
> (Pryce 1778, 150)

The design of the horse whim probably changed little over the centuries and illustrations from the 16th and 18th centuries may both depict the procedure similar to that in UPV in the 19th century. (Agricola 1950 ed., 165; Diderot 1959 ed., Plate 133) (See Fig. 5:26) According to Earl, a typical example consisted of a cage, 12ft in diameter and 4½ft high, turned by two horses treading a 36ft diameter path. Kibbles holding about 2½cwt could be raised 75ft - 100ft per minute. (1968, 68)

Remains of five whims are clearly visible at Eylesbarrow Mine.
1. On the S side of Whimb Shaft, **Mon 1109**, is a level platform, almost square in plan, measuring 8m by 9m and built up on the S side to a height 2.7m above the surrounding ground. There is no sign of a central bearing stone, though any details may be masked by the dense heather cover.
2. On the N side of Philip Shaft, **Mon X23**, is a semi-circular platform, 10m by 7m, at a height 3m above the top of the shaft. A large stone, 0.75m x 0.30m x 0.40m, lying off centre, may be the displaced bearing stone, though there is no trace of a characteristic blind hole. This whim is marked on contemporary plans. (WDRO WW21, WW20a)
3. On the S side of Henry's Engine Shaft, **Mon 1153**, is a level circular platform, defined by a low earthen bank, 12m in diameter. A central depression marks the original position of the bearing stone and a narrow channel leads from it to the edge of the spoil heap above the shaft-head. According to a report in Mining Journal, this was under construction in December 1847. (MJ 11.12.1847)

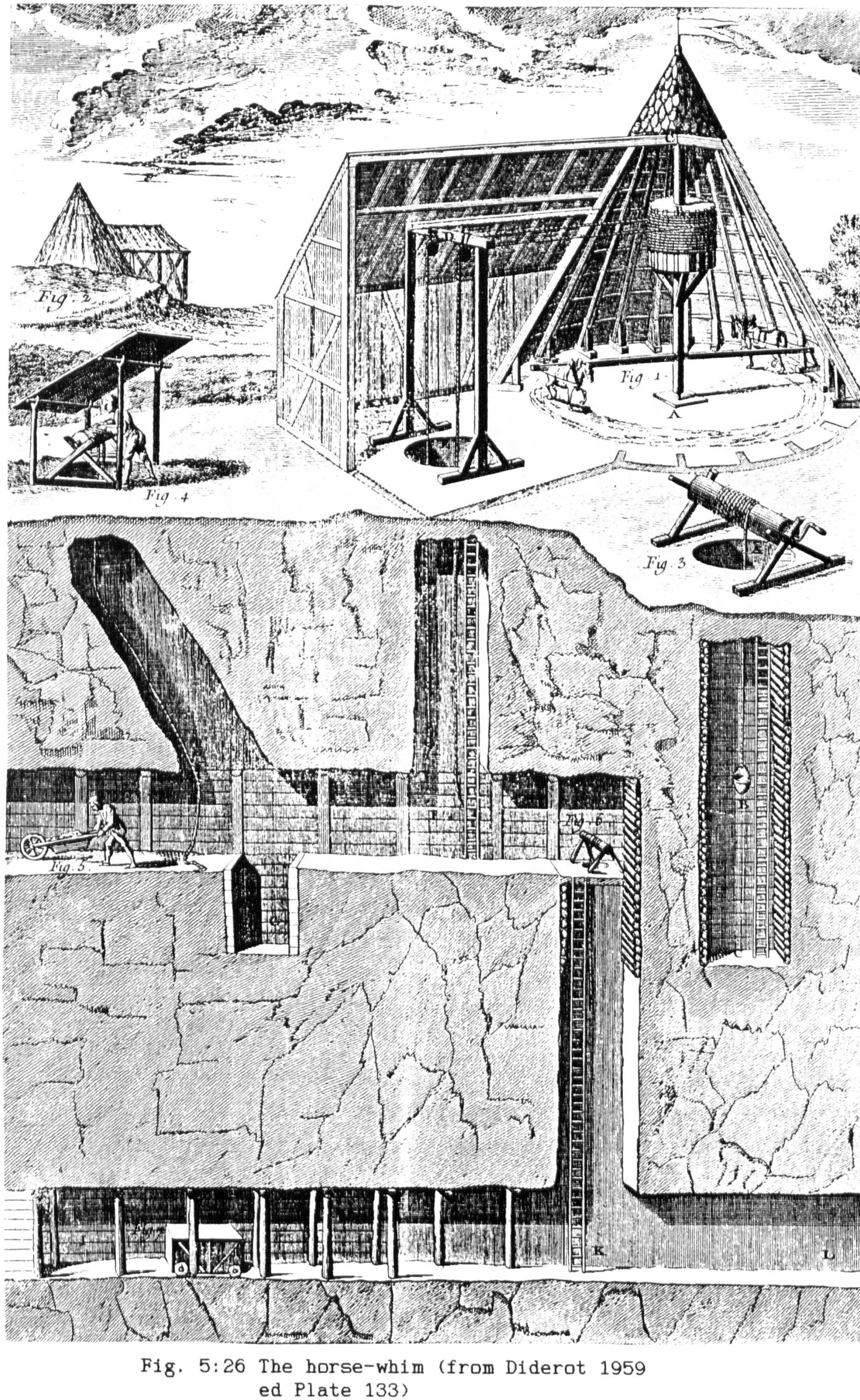


Fig. 5:26 The horse-whim (from Diderot 1959 ed Plate 133)

4. Two whims are visible at Pryce Deacon's Shaft, **Mon 1154**. The N whim consists of a well-defined level platform with a rectangular bearing stone, 0.60m x 0.75m, *in situ*. (see Plate 5:5) A blind hole, 0.09m in diameter, in the centre, represents the bearing. The stone is slightly off-centre within the whim; the radius is 6.20m to the E edge, but only 5.50m to the W edge. The S side may have caved in as the stone is only 3.50m from the edge. The S whim consists of a regular circular platform, of 6m radius, bounded by an overgrown stone bank. A central depression marks the original position of the bearing stone; a channel, running from the centre to the shaft, lines up with the bearing stone on the N whim.

Plate 5:5 Bearing-stone for the horse-whim at Pryce Deacon's shaft, **Mon 1154**

Another whim, recorded on contemporary plans on the N side of Old Engine Shaft, **Mon 1148**, may have been destroyed by the re-routeing of the track. (WDRO WW20a; WW21) The rectangular granite block, about 4ft by 1ft, set on edge, and bored with a 3½ inch blind hole, found by Cook, Greeves and Kilvington built into a low wall, may be the only relic. (1974, 184) There is no trace of apparatus at any of the shaft-heads but, presumably, this would have been removed. A "new whim" and whim ropes were advertised for sale in 1852. (MJ 25.9.1852)

While the whim may have been used for unwatering, it was probably used more often for raising ore. As Pryce Deacon's and Henry's Engine Shafts were pumped by engine wheel, **Mon 1111**, it might be supposed that the whims were for another purpose. However it might be difficult to raise ore and pump in the same shaft. Possibly the whims were required to unwater, when there was insufficient water to work the engine wheel or when the flat rod system, **Mon 1114b** was in operation.

Access for the miners would have required further equipment, though no archaeological evidence survives. A simple device, such as the windlass and stirrup, described by Carew would have been relatively easy to install (1811 ed., 36) but only applicable in vertical shafts. (RN Worth 1872, 25) RN Worth suggests (*ibid*) that ladders were a later introduction and were presumably used at Eylesbarrow, almost certainly in Old Ladderway Shaft and probably also in New Footway Shaft. Pryce observed that ladders were often positioned in disused shafts. (1778, 165) It is unlikely that Eylesbarrow miners benefited from a labour-saving device, such as the man-engine (moving ladders) introduced to the deeper Cornish mines in the 1840's. (Simonin 1869, 216-9)

Finally, some provision must have been made for ventilation, for which some archaeological evidence may survive. The excavation of air shafts was essential, and these could be sunk at intervals of 20 - 40 fathoms (36.6m - 73.2m) (Pryce 1778, 146) Some of the shafts in the Eylesbarrow area may have been excavated for this purpose, though it is not clear how these can now be identified. Earl noted that "old workings on a lode could often be traced on the surface by the row of "deads" [spoil] from these shafts in heaps across the fields." (1968, 65) Air shafts were recorded at Hooten Wheals and Hensroost, Hexworthy (Robins 1984, 23-4), and seven were marked on a 1866 sketch of "New Huntingdon Mine." (Brewer 1988, 8) No "air shafts" are specifically marked on the contemporary plans of Eylesbarrow (WDRO WW21, 20a and b) but possibly some of the smaller shafts in the area, not marked on the plans, were contemporary and intended for ventilation. The excavation of "winzes" probably also aided circulation of air underground.

If air shafts could not be provided, for example if the adit or drift was too deep, air could also be provided by means of an air pipe, conducted down another shaft and into the space below an arrangement of boards or "saller", laid about 1ft above the floor of the adit. (Pryce 1778, 146) The air pipe, of lead or leather, could be filled by bellows on the surface or by a funnel directed into the wind. (Tonkin 1811 ed., 38; Pryce 1778, 147)

5.7 THE PROCESSING OF TIN

After extraction, tin ore must be subjected to a series of dressing procedures in order to attain maximum purity prior to smelting. These procedures, designed to remove as much as possible of the gangue, are essentially based on two processes: crushing and concentration. Crushing involves the breaking up of parent material to separate tin ore from gangue. Concentration depends on the greater density of tin ore than gangue; thus, according to the principle of elutriation a gentle flow of water on crushed ore pulp will cause the denser ore to settle first while the less dense detritus is carried further in suspension. The series of procedures varies in complexity according to the nature of the ore. Tin ore extracted from an alluvial deposit has already undergone processes of crushing and concentration in the flow of the river, and it therefore requires less preparation than ore from a lode deposit, which can be accompanied by a considerable quantity of gangue.

The processing of tin is particularly well represented in UPV, where remains survive of a large complex consisting of seven dressing floors where crushing and an elaborate sequence of concentration procedures, as well as smelting, were conducted in the 19th century and three sites at which crushing and possibly concentration were carried out in an earlier period, possibly at some time between the 15th and 17th centuries. A distinction may be drawn between these early and later sites, based chiefly on the degree of complexity, and the scale of the operations, though excavation at the 16th century mill at W Colliford reveals a much greater degree of complexity than might be inferred from surface evidence alone. (Austin *et al* 1989)

5.7.1 Early Methods

a) Crushing

i) Hand Crushing

Nuggets of alluvial tin ore may only have required relatively light crushing. The preliminary treatment of lode ore, recorded by Carew, in which it was "first broken in pieces with hammers" may have been all that was required for stream tin. (1811 ed., 39) Recognition of this operation in the archaeological record might be difficult as hammering could have been executed simply on a bed of gravel or, as depicted by Agricola, on stone paving. (1950 ed., 272) Alternatively a large stone or rock outcrop could have been used as an anvil and repeated hammering or even grinding with a pestle, could have produced a depression similar to mechanically-produced mortars. (Tylecote 1987, 63; Hoover and Hoover 1950, 281)

A mortar formed by hand-operated hammer or pestle is difficult to distinguish from mechanically-produced mortars. Single mortars or collections of misaligned mortars on one stone can probably, though not conclusively, be eliminated as stamps-produced mortars. Thus Greeves suggests that the large groundfast stone with three or four misshapen and misaligned mortars at Outcombe, in the Deancombe Valley, may have been hand-worked. (1981, 211) Worth noted two stones with single mortars, at Ivybridge, in the Erme Valley, and at Outer Down, in the S Teign Valley, but Greeves is not convinced that these are mortars for crushing tin ore. (Worth 1940c, 213,218; Greeves 1981, 210)

Signs of wear on a granite ball found near a tin mill at Black Tor Falls, Meavy Valley suggested to Worth that it might have been used for hand-grinding or hammering. (1940c, 225,240) However the presence of iron stains suggests that it may have been held by a iron clamp and Greeves raises the possibility that it might have been a stone stamp-head. (1981, 217)

ii) Crazing Mills

Hand-crushed ore could have been further refined by grinding in a device, known as a crazing mill, similar to the grinding mills used for grain, though the only remains of crazing on Dartmoor occur at stamping mills, namely Gobbett near Hexworthy and two sites just outside UPV: Outcombe on Deancombe Brook and Yellowmead on Sheepstor Brook. (Worth 1940c, 241-2)

Crazing mills were used in conjunction with stamping mills possibly until the end of the 17th. Century in W Devon and such refinement may not have been necessary for stream tin, though mills solely for crazing may simply not have been identified. Millstones could easily become buried or may have been reused, while mills may often be interpreted as corn mills (Gerrard 1985, 180-1)

iii) Stamping Mills : Documentary Evidence

Lode ore is accompanied by a greater proportion of gangue and therefore requires more elaborate processing. The widespread exploitation of lode ore seems to coincide with the introduction of the stamping mill, possibly in the 15th century. (Greeves 1981, 212) The general adoption of water-powered stamps may have allowed the expansion of the industry at a time when alluvial deposits were waning. A connection between lode mining and mechanical stamping is perhaps evident, as Greeves points out, in a 1586 comment by Thomas Beare:

> "The streame work tyn is such a great graine of tyn that it is dressed and purified with small charges: but for that the myne tyn lyeth in the hard stone it must be stampt in stamping mills or grownd in craising mills."
> (quoted in Greeves 1981, 212)

Documentary evidence in Devon for stamping mills, sometimes called clashmills or Knacking/knocking mills, dates from the early 16th century. (Greeves 1981, 171) Few details of construction are available until Carew's account in 1602. According to Carew, after lode ore was roughly broken up with a hammer, it was brought to a stamping mill

> "where three and in some places six great logs of timber, bound at the ends with iron, and lifted up and down by a wheel driven with the water, do break it smaller."
> (1811 ed., 39)

A—MORTAR. B—UPRIGHT POSTS. C—CROSS-BEAMS. D—STAMPS. E—THEIR HEADS. F—AXLE (CAM-SHAFT). G—TOOTH OF THE STAMP (TAPPET). H—TEETH OF AXLE (CAMS).

Fig. 5:27 The stamping mill depicted by Agricola (from Agricola 1950 ed, 284)

Further details of construction are provided by Agricola. (1950 ed., 279-285) (See Fig. 5:27) A mortar box, 2ft 6 "digits" [?inches] long by 1ft 6 "digits" [?inches] deep, and lined with iron plate, is placed on the ground and fixed to two upright posts. Crossbeams bind the upright posts together 2½ft and 6ft above the mortar box.

> "These cross beams have square openings, in which the iron-shod stamps are inserted ...... Each stamp has a tappet at the back, which requires to be daubed with grease on the lower side that it can be raised more easily. For each stamp there are on a cam-shaft, two cams, rounded on the outer end, which alternately raise the stamp, in order that, by its dropping into the mortar, it may with its iron head pound and crush the rock which has been thrown under it. To the cam-shaft is fixed a water-wheel whose buckets are turned by water-power ..... the stamp-stems are made of small square timbers nine feet long and half a foot wide each way......"(Agricola 1950 ed., 279-285)

An iron head is attached to the stem, secured by a broad iron wedge. Initially ore was kept dry for stamping. Carew (1811 ed., 39) noted that "if the stones be over moist they are dried by the fire in an iron cradle or grate" and the stamping mill may have been provided with some form of roof to keep the ore dry. (Worth 1940c, 244) However, dry stamps could not reduce the ore to sufficient refinement, so that "from the stamping mill it passeth to the crazing mill, which ... bruiseth the same to a fine sand." (Carew 1811 ed., 39) It was later discovered that finer crushing could be achieved when the ore was kept wet, so that the crazing mill was no longer necessary. (Worth 1940c, 244; Earl 1968, 77) After a short interval in Germany, and a longer interval in Cornwall, wet stamping was introduced. (Greeves 1981, 214) Agricola recommended that the head of a wet stamp be "larger by half" than the head of a dry stamp and that the stamps should fall on an iron plate or on "a slab of hard, smooth rock." (1950 ed., 312) The two methods were practised simultaneously in mid-16th century Germany; Agricola describes a double stamping mill, in which one set of stamps could be devoted to dry stamping and the other to wet stamping. (1950 ed., 287) Carew seems to have been writing during the transitional period between dry and wet; thus "of late times they mostly use wet stampers". (1811 ed., 39) Dry stamping continued alongside the wet, and was still practised in the late 17th century. (Greeves 1981, 214) The two methods may be distinguishable from field evidence. For example, at West Colliford, the channels acting as "launders", revealed by excavation, running from the stamps area to the buddles are indicative of wet stamping. (Austin *et al* 1989, 101-3) Austin, Gerrard and Greeves suggest that a similar "launder" may run under the W wall of Langcombe mill, **Mon 1084**, towards the R Plym, visible today as a channel, capped with stones; leading away from the mortarstone. (*op. cit.*, 123)

iv) Stamping Mills : Field Evidence

Details of three early stamping mills surviving in UPV, **Mons 1004, 1084** and **1089**, are summarised in Table 5:4. The UPV mills are traditionally referred to as blowing houses, for example on OS Maps, but there is no evidence that any activity other than stamping was carried out at these sites. Occasionally tin mills served two or three purposes; thus Greeves recorded field and/or documentary evidence of stamping combined with blowing at 18 Devon mills. (1981, 185) Stamping, blowing and crazing were carried out at Gobbett and Yellowmead. (Worth 1940c, 215-6,226)

However, Greeves restricts designation as a blowing house to mills with documentary evidence or diagnostic field evidence of a furnace, a mould or slag. (1981, ch 22) Greeves is only convinced by two of the furnaces recorded by Worth and is cautious about recesses which Worth suggested might have contained renewable furnaces of perishable material. (Greeves 1981, 241-2; Worth 1940c, 232-6) It is just possible to identify the recess at Colesmills, **Mon 1004**. (See Fig 5:28) Worth suggested that a blast furnace could have been located between the NW end of the SW wall and a parallel inner partition or "wing wall" which abuts the inner face of the NW wall. (1940c, 221) The plan is confused by a quantity of tumbled stone and it is not possible to distinguish the space or recess between the two parallel walls, though Worth recorded a width of 3ft 7inches (1.09m) and a depth of 4ft 4inches (1.42m) (*ibid.*) The outer wall face of the wing wall is clearly visible projecting 2.20m from the inner face of the NW structure wall. A large flat but tilted slab lying on loose stones may be the flat slab depicted by Worth, upright and flanking the structure wall but now displaced. (*op.cit.*, 233)
Greeves added Lower Hartor Tor mill, **Mon 1089**, to the list of mills with recesses. This structure, built into the steep scarp of the river bank has two small recesses inserted into the W end. A lintel survives over the S recess.

Table 5:4 Upper Plym Valley Medieval Tin Mills.

	COLESMILLS (Mon 1004)	LANGCOMBE (Mon 1084)	LOWER HARTOR TOR (Mon 1089)
DIMENSIONS OF WHEEL PIT	4.00m x 0.70-0.90m (3.00m below axle)	? m x 0.75m (3.50m below axle)	?
ESTIMATED SIZE OF WHEEL	? 9ft.(2.74m) x 2ft.(0.61m)	? m x ? 2 ft(0.61m)	?
BUILDINGS INTERNAL DIMENSIONS	7.70m x 4.00m	4.60m x 3.00m	3.50m x 2.70m
MORTAR STONES	1. 2 complete mortars 210mm x 160mm x 9mm 180mm x 210mm x 10mm 2. 1 complete mortar 200mm x 180mm x 10mm + 1 broken 3. 1 complete mortar 140mm x 150mm x 6mm + 1 broken 4. 2 complete mortars 5. 1 complete mortar 230mm x 160mm x 11mm 1 broken mortar 6. 1 complete mortar 140mm x 130mm x 4mm 7. 1 complete mortar(square) 210mm x 210mm x 10mm	1. 2 complete mortars 260mm x 340mm 230mm x 290mm 1 broken mortar	1. 2 broken mortars recorded by Greeves (1981,201)

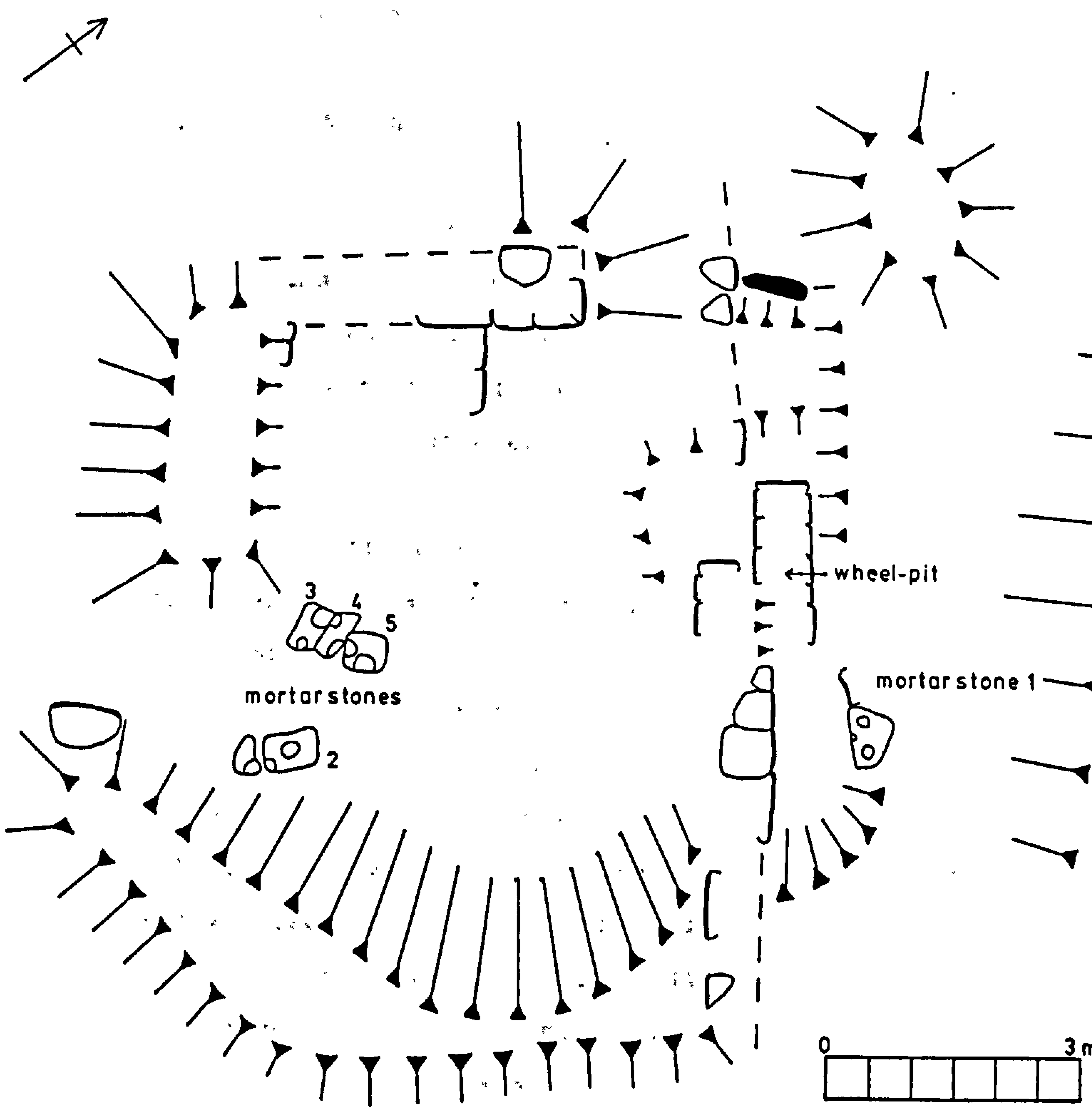


Fig. 5:28 Colesmills stamping mill, Mon 1004

It might be assumed that a blast furnace will be located near the wheel pit to facilitate the functioning of the bellows. One certain Medieval blast furnace at Avon Dam (Greeves 1981, 234-5) and the 19th century blast furnace, **Mon 1066c**, at Eylesbarrow, are both located close to the wheel. Therefore, Greeves concludes that a recess located at some distance from the wheel, as in both UPV examples, might be unlikely to house a blast furnace. (1981, 244) Furthermore, as Greeves points out, recesses provided with lintels, such as the S recess at Lower Hartor Tor, are much more likely to be simple fireplaces rather than furnaces and he suggests that they could have been used for drying ore, as described by Carew, before dry stamping. (Greeves 1981, 242; Carew 1811 ed., 239) Moreover, it is not unreasonable to suppose, as Greeves also points out, that a fire may have simply been for domestic purposes, presumably welcome in such an inhospitable environment. (1981, 248)

Therefore, only corroborative evidence of a mould or slag would allow such recesses to be accepted as blast furnaces. No evidence has been recorded of moulds or slag at any of the UPV mills, but evidence may exist awaiting discovery by excavation. A possible mouldstone found in a wall at Ditsworthy Warren House is perhaps more likely to be from Eylesbarrow. ("Nobbut" 1988, 14) (see Plate 5:6) The trough at Hentor Farm, **Mon 9101**, has a cavity, trapezoidal in plan, and therefore falls short of the neat, rectangular shape of moulds recorded by Greeves. (1981, 223) (see Plate 5:7) However, the slight, but doubtful, possibility remains that it was an unfinished mould similar to one suggested by Worth from near Yeo Farm, R Meavy. (1940c 223-4) The actual size of the cavity (430mm and 400mm at the ends, 550mm and 400mm at the sides, 80mm - 100mm deep) is almost within range of Greeves' standard size of 400±50mm × 300±50mm and 100mm - 130mm deep. (1981, 223) Excavation might also demonstrate the presence of a crazing mill on these sites; it has already been noted that the millstones are liable to become buried, perhaps particularly where a great quantity of rubble and loose stone exists as on all three UPV sites. However , at present, conclusive evidence exists only for stamping in UPV, though blowing was conducted in the immediate neighbourhood at Brisworthy Burrows. (WDRO 72/1033; Greeves 1981, 221)

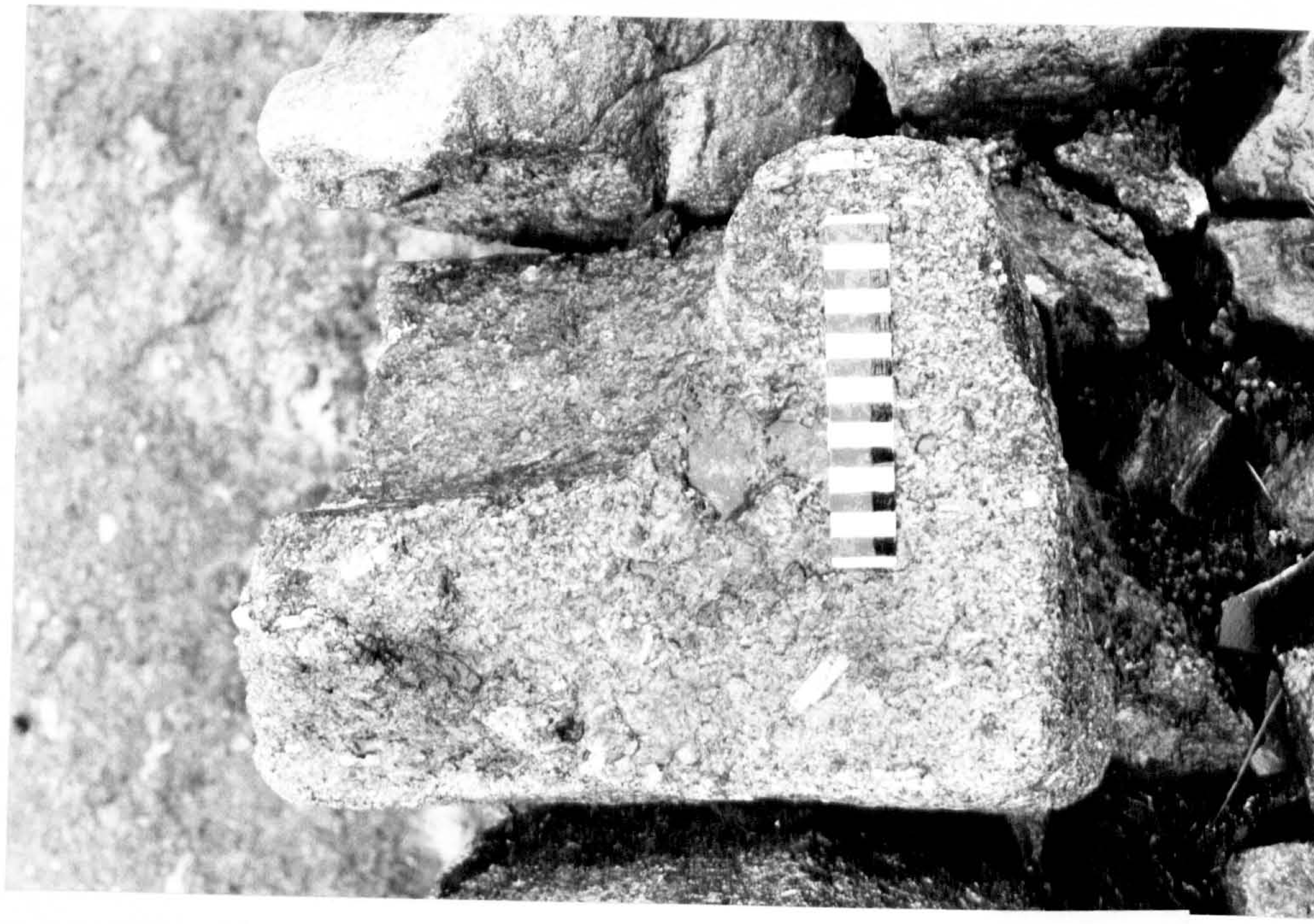


Plate 5:6 Possible mould-stone at Ditsworthy

Plate 5:7
Trough at Hentor Farmstead, **Mon 9101**

It is interesting to speculate which tinworks might have been associated with these mills. If stamping is chiefly concerned with lode ore, then it might be supposed, as Greeves suggests (1981, 186), that the distribution of stamping mills would reflect the distribution of lode ore, and, indeed, Gerrard (1986, 125) found a close correlation between the distribution of lodeworks and that of stamping mills in Cornwall. The West Colliford mill was situated directly below a large openwork. (Austin *et al* 1989, Fig. 2:13) The three UPV stamping mills are certainly adjacent to lodeworks, for example in the Eylesbarow area, though are more closely associated with streamworking. Langcombe and Lower Hartor Tor might have been associated with openworks at Evil Combe and around Crane Lake. While the implication might be that the stamping mills were associated after all with streaming, it is perhaps more likely that other factors contributed to the choice of location. While the presence of tin deposits in the general area of the Upper Plym Valley warranted the construction of stamping mills, the precise location was dictated by, for example, water supply or shelter. However, if Langcombe and Lower Hartor Tor were associated with the Crane Lake deposits, there seems to be no plausible reason why a mill could not have been erected further upstream on the R. Plym, nearer the openworks. In this case, different factors, such as availability of land for rent, may have been significant.

Surface remains give little indication of the date of construction; one or all may have been among the "Tynne Milles neare the Rivers of Plym and Mew", held partly responsible for silting up Cattewater in Plymouth Harbour in 1638. (WDRO W9) (see above p. 359) These mills may have had a long life; for example at the excavated mill at West Colliford, Bodmin Moor, the surprising quantity of pottery may date from a period of 150 years from late 15th to early 17th centuries, while the evidence, mostly from the recutting of leats, suggests at least 15 separate phases of activity associated with tinworking. (Litt and Austin 1989, 161-164; Austin *et al* 1989,69)

v) The Stamping Mill : Structural Details

Excavation would greatly increase our understanding of Medieval tin mills. Very few have been excavated or even cleared in Devon or Cornwall. Greeves lists four Devon mills, which have been cleared: the combined blowing and stamping mills at Avon Dam, Thornworthy and Week

Ford and the unverified blowing mill at Deep Swincombe. (1981, 21) The first professional excavations of tin mills, namely the two mills at Colliford, Bodmin Moor, indicate the amount of information that can be gathered. (Austin *et al* 1989) However, details of surface remains, recorded notably by Worth (1940) and Greeves (1981), also provide valuable comparitive evidence.

The Mill Building

Compared with Greeves' record of sizes of Devon mills, the UPV mills are relatively small. (1981, 176) (See Table 5:4) Out of a total of 58 mills, Greeves calculated average internal dimensions of 10m by 5m. (*ibid.*) He suggests that smaller size may indicate an early date or may reflect a single industrial activity rather than stamping combined with crazing or blowing. (*ibid.*) There is no visible trace of an original floor at UPV mills; Burnard suggests that the granite gravel floor found after clearing loose stone from Week Ford mill would have provided a "good hard working bottom." (1888/9, 227) Part of the floor at West Colliford was cobbled while the remainder may have been timber-floored or simply "puddled" in the wet conditions. (Austin *et al* 1989, 103)

Wheel Pit and Wheel

The remains of Langcombe and Lower Hartor Tor mills are not sufficiently well-preserved to estimate the original size of the wheel pit. At Lower Hartor Tor, **Mon 1089**, the wheel pit is distinguishable as a broad, rubble-filled trench, flanked on the E side by a sloping bank and on the W side by a wall. At Langcombe, **Mon 1084**, the E wall of the mill marks the W side of the wheel pit, now visible as a trench, 0.75m wide. (See Fig. 5:29) At Colesmills, **Mon 1004**, both sides of the pit are lined with stone, defining a pit, 0.90m wide, which could have accomodated a wheel, 2½ft (0.76m) to 2ft 8inches (0.81m) abreast. However, this pit narrows to a width of 0.70m, only 1m NW of the axle. A wheel under 6½ft (2m) in diameter seems unlikely, considering that the smallest diameter estimated by Worth was 8ft (2.44m). (1940c, 231-2) Therefore, the breast of the wheel must have been small enough, possibly 2ft (0.61m), to fit in the narrower part of the wheel pit. The pit seems to continue for 3m beyond the axle, though the wheel did not necessarily extend to the full length of the pit. (See Fig.5:28) Worth suggested that Colesmills was furnished with a wheel, 9ft by 2ft (2.74m by 0.61m), which accords well

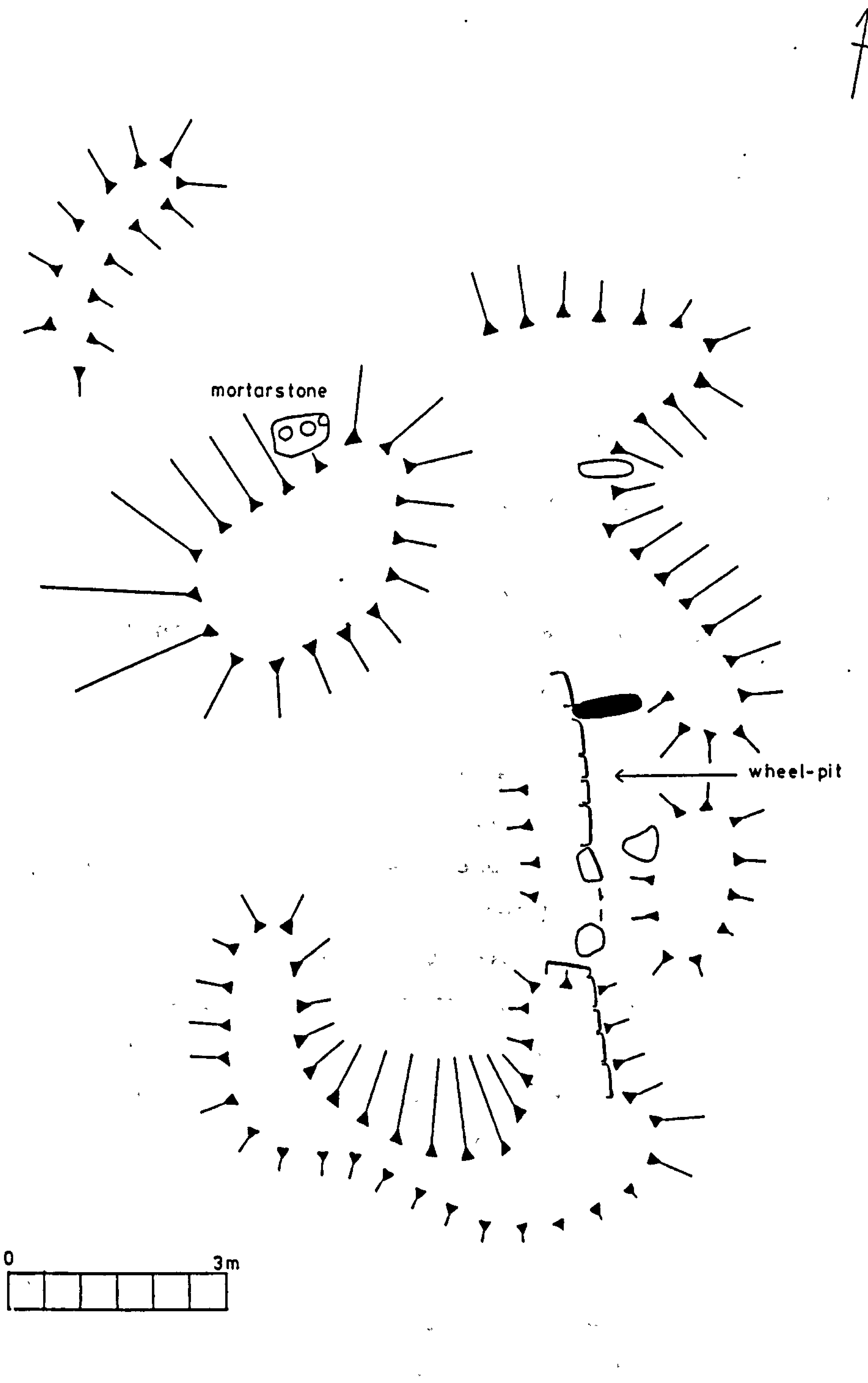


Fig. 5:29 Langcombe stamping mill, Mon 1084

with his estimated average diameter of 9ft - 9ft 3inches (2.74m - 2.82m), though is rather wider than his average width of 1ft 3inches - 1ft 6inches (0.38m - 0.46m). (Worth 1940, 221, 231-2) A similarly long pit may have been in use at Langcombe mill, **Mon 1084**, where a large upright slab set across the trench seems to mark the end of the wheel pit, 3.50m from the axle. (See Fig. 5:29)

Worth suggested that the average wheel could have carried 130 cubic feet of water per minute, developing 1.33 HP. (*op.cit.*, 232) However, he added that "leats were not designed for such a flow" and suggested that 60 cubic feet per minute, developing 0.66 HP is a more likely capacity. (*ibid.*) Palaeohydrological studies at West Colliford offer exciting prospects of what can be discovered about flow depths, velocities and discharges of leats. (Park 1989, 204-223) All three UPV mill wheels were almost certainly overshot. In each case the mill is set at the foot of the streamers' escarpment, allowing a leat to be brought along the top of the slope with ease. The leat, **Mon 1005**, almost certainly served Colesmills, **Mon 1004**, and possibly the leat, **Mon 1053**, was associated with Lower Hartor mill, **Mon 1089**.

The position of the axle at Langcombe is indicated by a "step" in the W wall of the wheel pit. At Colesmills the axle can be even more precisely located; a groove, 60mm wide and 30mm deep, cut horizontally for 50mm on the E edge of the pit, was presumably a bearing for the axle. (See Plate 5:8) Greeves recorded such bearings at 14 Devon tin mills, though only in three other cases, *in situ* as at Colesmills. (1981, 190) He concluded that the width of the bearing, usually 35mm to 50mm, though at Colesmills 60mm, must be the maximum diameter of the axle. (*ibid.*) The Colesmills bearing, like two other examples, was on a discarded mortar stone. (*ibid.*)

<u>Mortarstones</u>

Mortarstones are named after the shallow depressions or "mortars", which they contain on one or more faces. The term "mortar" may be misleading; as Parsons stresses, the depressions are not pre-fabricated for use with a pestle, but are by-products of the hammering action of the stamp. (1956, 194)

Plate 5:8 Mortarstone at Colesmills: stone 1

Plate 5:9 Mortarstone at Colesmills: stone 2

Plate 5:10
Mortarstones at Colesmills: stones 3, 4 and 5

Plate 5:11 Mortarstone at Colesmills: stone 6

Plate 5:12 Mortarstone at Colesmills: stone 7

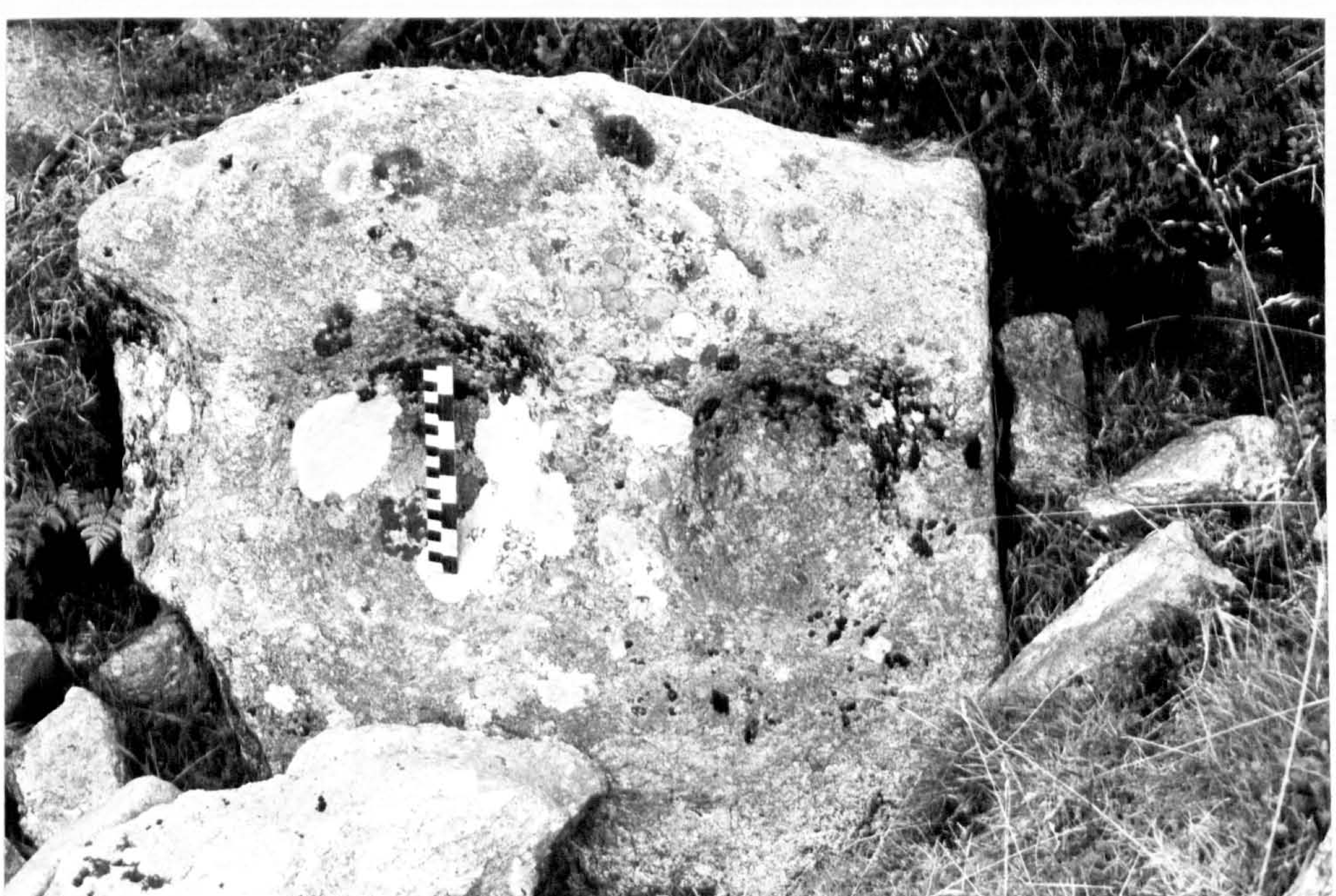


Plate 5:13
Mortarstone at Langcombe stamping mill

Their use as anvils in mechanical stamping was first deduced by Worth from the consistency of spacing between mortars, arranged in pairs, on stones from a single mill. (1946, 282) Seven mortarstones were found at Colesmills, another at Langcombe and two broken stones were found by Greeves at Lower Hartor Tor. (Greeves 1981, 201) (see plates 5:18-5:13)

Blocks of fine-grained granite were preferred, though occasionally quartz-schorl was used. (Worth 1940c, 240) As Greeves points out, the multiple use of single stones suggests that they were carefully selected. (1981, 199) The mortars are usually arranged in pairs or triples, which indicates the use of two or three stamp heads. Both types seem to have been in use in UPV; the broken stone at Langcombe seems to be the remains of a triple mortar,while double mortars were used at Colesmills. Greeves found that double mortars were more common in Devon, but that triple mortars predominated, admittedly within a smaller corpus, in Cornwall. (1981, 208)

Worth found that the space between mortars, and therefore between stamp heads, was between 9inches and 14inches (230mm and 355m) with an average of 10inches (255m). (1946c, 282) However, Greeves extended this range to between 190mm and 380mm, with an average of 276mm. (1981, 202) Greeves found that out of 53 double mortarstones, the individual mortars were usually oval with average conjugate diameters of 165mm and 180mm, within a range from 110mm to 350mm. The depth ranged from 30mm to 95mm. (1981, 204) The mortars on triple stones were, on average, larger, deeper and more oval, and the central stone was often slightly smaller and more elongated. Out of 25 certain triple stones, the average conjugate diameters were 215mm by 255mm, for outer mortars, and 205mm by 260mm, for central mortars. (*op.cit.*, 209)

All the mortars in UPV fit this pattern. The complete mortars surviving at Colesmills are mostly in the middle of the range for double mortarstones. (See Table 5:4) Mortars in the triple stone at Langcombe are larger, though here, the central mortar is not smaller than the one complete outer mortar. (See Table 5:4)

The similarity in the ranges of space between mortars in double and triple mortarstones suggests that there was no distinction between the spacing of stamp heads in double or triple stamps. Mortarstones may provide a clue to the shape of the Medieval stamp head. Agricola depicted square stamp heads in use in 16th century Germany. (See Fig.5:27) Greeves noted a few examples of squarish mortars, which may have resulted from the use of a square headed stamp. (1981, 204) These included two examples at Colesmills (Stone 2 and particularly Stone 7). (See Plates 5:9 and 5:12) However, Greeves concludes from the predominantly oval shape that the stamp head had a rounded end.

Machinery in Medieval, as in late tin mills was consistently removed, so that mortarstones are often the only visible remains of stamping equipment. However, further details can be revealed by excavation.

It is assumed that the stamps must have been supported by some kind of frame, as depicted by Agricola. (See Fig. 5:27) Worth suggested that a slot, 12inches (305mm) long, 3 1/4 inches (82mm) wide and 3 1/4 inches (82mm) deep, cut into a stone, which also contained bearings for an axle, at Hook Lake in the Erme Valley, may have been a setting for a wooden stamps frame. (1940c, 249-50, Pl XIX) However, at West Colliford, the only evidence of the stamps was a large pit (2.4m X 1m), probably enlarged, as Austin, Gerrard and Greeves suggest, in the removal of the machinery, and a displaced bearing stone for the axle. (1989, 99)

Agricola recommended placing "an iron plate full of holes" in the open end of the mortar box of a wet stamper, presumably so that ore could pass through only when reduced to the required size. (1950 ed., 312) The use of this device was also known in Cornwall; thus a grate was recommended by Pryce (1778, 220) and included in the accounts of a stamping mill at Harvenna. (Gerrard 1986, 129) Furthermore, Austin, Gerrard and Greeves suggest that the piece of bronze sheeting inscribed with a grid pattern and perforated with round holes from West Colliford mill may be a fragment of such a grate. (1989, 101, 170-1 Fig 4.15)

b) Concentration

Early methods of concentrating particles of tin after crushing may have been relatively simple. Carew describes the late 16th century process adopted in Cornwall:

"the stream after it hath forsaken the mill, is made to fall by certain degrees [steps] one somewhat distant from another, upon each of which at every descent lieth a green turf, three or four foot square and one foot thick. On this the tinner layeth a certain portion of the sandy tin, and with his shovel softly tosseth the same to and fro, that through this stirring the water which runneth over it may wash away the light earth from the tin, which of a heavier substance lieth fast on the turf." (1811 ed., 39-40)

Greater refinement was achieved in a second stage of concentration, similar to gold panning:

"After it is thus washed, they put the remnant into a wooden dish, broad, flat, and round, being about two foot over and having two handles fastened at the sides, by which they softly shog [shake] the same to and fro in the water between their legs as they sit over it, until whatsoever of the earthy substance that was yet left be flitted away. (*op.cit.*, 40)

The second stage is unlikely to survive in the archaeological record, while the first stage might be difficult to identify. Turves may have been arranged in the tail race below the wheel pit and it is possible that a large upright slab set transversely across the tail race at Colesmills, 5.30m from the axle, was associated with this preliminary washing. (See Fig. 5:28) The slab could have acted as a barrier, above which the turf "filters" were placed, similar to the arrangement of turf and stones described by Agricola for sorting stream tin in a "tye". (See above p.385) (See Fig.5:12)

However, concentration in early mills may have been more elaborate. It is possible that rectangular pits, often stone-lined, known as settling pits or buddles, which were well-known on 19th century dressing floors in Devon and Cornwall and described in detail below (p.504), were also used on earlier mills. Buddles played an important role in the dressing procedure described by Agricola and consisted of a timber-lined "box", 15ft (4.57m) long and 1½ft (0.46m) wide, in which the 3ft (0.92m) long upper compartment or "head" was at a higher level than the rest of the buddle, which was sunk 8inches (203mm) into the ground. (1950 ed., 300) Crushed ore was sieved before concentration in the buddle and then:

"the washer throws it into the head of the buddle, and water is poured upon it through the pipe or small trough, and the portion which sinks and settles in the middle of the head compartment he stirs with a wooden scrubber ...... The water is made turbid by this stirring, and carries the mud and sand and small particles of metal into the buddle below. Together with the broken rock, the larger metallic particles remain in the head compartment..." (*op.cit.*, 301)

The material collected in the head and lower compartments could then receive further refining treatment separately.

Buddles were relatively shallow and would have filled in fairly rapidly after use. They would therefore soon be hard to detect in the field, particularly if the wooden or stone-lining was removed but some depressions, which may originally have been buddles, are still visible on mill sites. Thus an elongated stone-lined depression downhill from a possibly 16th century crushing mill at Retallack, Constantine parish, Cornwall, is thought to have been a buddle. (Gerrard 1985, 179) At the same site, two fragments of crazing mill stones set on edge may, as Gerrard suggests, be the remains of another. (*ibid.*) In Devon, Greeves recorded three possible settling pits at the tin mill on the right bank of the R Walkham above Merrivale, two possible pits at the unverifed mill site at Ivy Tor Water (1981, 219, 220, Fig 10) and two possible pits at the ?16th century mill at Fishlake Foot on the R Avon. (1985, 37, 35, Fig 22) He also detected two possible settling pits SW of Langcombe tin mill, **Mon 1084**, though these are difficult to identify in the uneven, disturbed ground. (1981, 219). Excavation will be the best means of verification. Thus excavation at West Colliford revealed five pits in three phases, including two stone-lined pits in a later phase, which were all identified as buddles, in addition to an area near the river, interpreted as a settling area for the treatment if fine slimes. (Austin *et al* 1989, 108-114)

Despite limited field evidence, it may be assumed that dressing was more sophisticated than suggested by Carew. After smelting tin in an experimental furnace, Earl concluded that "a high degree of skill was required for the concentration work". (1986, 27) Thus, selective stamping, careful concentration and accurate assaying were essential in order to supply blowing houses with black tin of the 70% purity required. (*ibid.*)

5.7.2 Later Methods

> "By 1700 tin dressing procedures had developed to a point where they remained unchanged, on some dressing floors, until the 20th century." (Earl 1968, 77)

The methods used in the 18th and 19th centuries followed the same principles of crushing and concentration as on earlier tin mills, but were more elaborate, presumably more efficient and on a larger scale. The later methods are particularly well-represented in UPV, where seven individual dressing floors were constructed contemporaneously in the 1820's for Eylesbarrow Mine. They were probably in use or under construction when they were marked on the 1823-31 Plan of Ellisborough Tin Mine, though their use may have been relatively short-lived; stamping in later episodes was on a much smaller scale. (WDRO WW21) Six floors, **Mons 1094, 1093, 1091, 1070, 1066** and **1064**, are arranged in a series along Upper Drizzle Combe and the seventh, **Mon 1185**, is located at Crane Lake in the Wheal Katherine Tin Sett, though it is marked on the Plan of Ellisborough Tin Mine as if part of the Eylesbarrow operations. A rectangular building is also marked on this plan between Deancombe Brook and the Deancombe - Eylesbarrow track. Greeves suggests that this may denote the stamping mill at SX 585683, which thus might have been worked in conjunction with the others in the 19th century, though may have a much longer history. (WDRO WW21; Greeves 1969, 198, 201)

The operation of the 19th century dressing floors in UPV is much better understood than that of the earlier tin mills, though excavation would improve interpretation further. The 19th century remains are better preserved and benefit from the survival of the working practices into the 20th century on other Dartmoor mines. Documentation is thus more comprehensive; photographs of machinery in operation or abandoned *in situ* in the late 19th and early 20th centuries allow much greater understanding of the equipment and technology. Some caution is required as mines surviving into the 20th century benefited from more advanced technology than that known at Eylesbarrow. Detailed records of contemporary West Country practices also enhance interpretation of field evidence and the illustrated accounts by Borlase in 1758 and Pryce in 1778 probably describe procedures very similar to those adopted in UPV in the 1820's. The later methods of processing tin ore have already been fully described, in general terms, by Earl (1968, 77-97) and with particular reference to Eylesbarrow Mine by Cook, Greeves and Kilvington (1974, 184-193).

a) Dressing Floors The most striking distinction between the 19th century and earlier processing is the scale of the later operations. The six floors alongside Upper Drizzle Combe were designed as a single industrial complex. (Sheets 25 & 30) The tailrace of the engine wheel, **Mon 1097**, was directed into a channel which supplied each dressing floor in turn. From the tailrace of each stamping mill, the leat was directed onto a massive earthen embankment, presumably within a wooden launder, and conveyed to the overshot wheel of the next stamping mill At the head of each wheel-pit is a small by-pass channel designed to divert water from the wheel if the stamps were not in use. Water from the leat was also used to keep the stamps wet and to wash and grade the ore in settling pits. Barton suggests that about 400 gallons of water were required to process 1lb of cassiterite. (1965, 222) Just above the fourth stamping mill, **Mon 1070**, the water supply was augmented by the Stamping Mill Leat, **Mon 1052**, which brought water from the R Plym, near Evil Combe. This may have been constructed when the supply from the tailraces, ultimately deriving from the Engine Leat, **Mon 1075**, was found to be insufficient. This was probably early in the history of the mine as this leat appears on the 1823-31 Plan. (WDRO VW21)

Although the six floors at Drizzle Combe were part of a single complex, they were not necessarily worked simultaneously. Each floor was a self-contained unit with facilities for crushing, concentration and storing. The large capacity of the processing complex at Eylesbarrow suggests to Cook, Greeves and Kilvington that ore from other mines may have been brought in for dressing. (1974, 190) They concede that there is no documentary evidence for this, but point out that ore from Eylesbarrow Mine alone would not have required such extensive processing works. (*ibid.*) The seventh floor, **Mon 1185**, which is also self-contained with facilities for every stage of processing from crushing to "recking" (described below), may have been an independent unit, treating ore from Wheal Katherine.

While the design of the stamps and settling pits changed little after the earlier period, the layout of these features on individual processing units seems better organised and well-spaced. Conditions for the workforce were perhaps more rugged in the open air, but the larger floor area provided greater space for storage and working in contrast to the cramped conditions of early tin mills.

Each dressing floor consists of a fairly level platform, terraced into the slope and defined on two sides by an embankment with an internal revetment of small dry-stone masonry. Buddles and settling pits were dug into this floor, often connected by underground channels. The large areas of empty space were probably, as Cook, Greeves and Kilvington suggest, necessary for accumulating heaps of ore at various stages of refinement. (1974, 192) Ore may have been stockpiled until an adequate batch for processing had been collected. The larger size of the floors at the two double stamping mills, **Mons 1064** and **1185**, is probably proportional to the greater amount of material processed by two sets of stamps. A comparison of sizes of the dressing floors is listed in Table 5:5. A subsidiary floor was provided at stamping mill, **Mon 1064**, and it is possible that another stamping mill was intended here; the Plan of Ellisborough Tin Mine labels this site "Treble Stamping Mill". (WDRO WW21)

Another dressing floor, **Mon 1198**, is situated at Wheal Katherine, next to Frank's Shaft, **Mon 1199**. No trace survives of buddles in the floor but mounds, built against the rear wall, suggest that inclined boards were used for sorting. Absence of a leat and, indeed, absence of a sufficient water supply in this elevated position would seem to preclude water-sorting. It could, therefore, have been used for storage and some preliminary sorting before removal to **Mon 1185**. It is possible that a well-defined rectangular area, **Mon 1101**, on the N side of the Reservoir, **Mon 1100**, had a similar function, perhaps associated with Shallow Adit.

b) <u>Crushing</u>

No information about the stamping equipment of the 1820's and 1830's is provided on the contemporary plans. It is not even certain if stamps and wheels were erected at all the dressing floors. However a few more details appear in the <u>Mining Journal</u> about the situation in the 1840's. The early stamping equipment seems to have remained on the site; reports on the 1847 re-opening refer to the "repairing" of stamps wheels and to "the stamp heads ... used by the late proprietors, [which] are still upon the property". (<u>MJ</u> 5.6.1847; 21.8.1847) However, although

Table 5;5 Eylesbarrow Dressing Floors ; Dimensions of floors, wheel pits, wheels and Coffers.

MONUMENT	DRESSING FLOOR	WHEEL PIT	ESTIMATED SIZE OF WHEEL	WIDTH OF COFFERS
MON. 1094	20,0m x 25,0m	c.4,50m x 1,10m	12 ft. x 2 ft. (3.66m x 0.61m)	2,30m. ext 1,0m int. Bearing block in situ.
MON. 1093	20,0m x 23,0m	6,20m x c.1,20m	18 ft. x 3ft. (15.50m x 0.91m)	2,50m ext. c.1.0 - 1.50m int.
MON. 1091	17,0m x 14,0m	6,30m x 1,00m	18 ft. x 2ft. (5.50m x 0.61m)	2,10m ext. ? int. Bearing block in situ.
MON. 1070	18,2m x 19,4m	5,70m x ? Wide	15 ft. x 2ft. (4.70m x 0.61m)	2,50m ext. ?int.
MON. 1066	36,0m x 20,0m	6,80m x 1,00m	20 ft. x 2ft. (6.10m x 0.61m)	Not measured.
MON. 1064	55,5m x 27,5m (Subsidiary floor 16,0m x 23,0m)	7,20m x 1,00m	22 ft. x 2ft. (6,71m x 0,61m)	SW 3,10m ext 1,90m int Bearing block fallen in buddle. NE 2,50m ext 1,30m int Bearing block in situ.
MON. 1185	32,0m x 13,0m (Subsidiary floor 17,0m x 7,5m)	8,60m x 0,60m	25 ft. x 1ft 6 ins. (7,62m x 0,45m)	SE 2,30m ext 1,10m int. 17,0m x 7,5m) NE 2,50m ext 1,50m int Bearing block in situ

successive reports on the 1847 operations refer, for example, to "get on with our stamps as fast as possible", stamping may not have commenced immediately. There is no field evidence for the plan to work nine stamp heads with a new 30ft by 2½ft wheel in the old engine house, **Mon 1097**, or the plan to work stamps in the tailrace of the 50ft wheel. (MJ 3.7.1847; 21.8.1847) Renewal of stamping was first recorded in January 1849, as part of a new venture, Aylesborough, though only with six heads of stamps. (MJ 6.1.1849) It was probably these, which were advertised for sale in 1852 along with a "New Stamps' Wheel". (MJ 25.9.1852)

The UPV machinery was probably very similar to the abandoned stamps at the adjacent Kit Mine, Colleytown, Sheepstor, photographed in 1928 (Harris 1968, 72), and to the late 19th century stamps recorded at Wheal Prosper, Lanivet near Bodmin by Gerrard and Sharpe. (1985, 206-7) (See Fig. 5:30) A comparison of these with the 16th century model depicted by Agricola (See Fig. 5:27) reveals that design has changed little, but that for some components iron has replaced wood. Thus the stamp frame and stamp stems, known in 19th century Cornwall as "lifters", were still composed of wood, but the cross-pieces or "saddles", into which the lifters were inserted, were cast iron. (Gerrard and Sharpe 1985, 207) The stamp heads were iron, as they had been in 16th century Germany and Cornwall, but weighing in the 18th and 19th centuries usually 140lbs each. (Agricola 1950 ed., 284-5; Carew 1811 ed., 39; Borlase 1758, 178) The cam shaft, known in the 19th century as the "stamps barrel", was also cast iron, as were the detachable cams and stamp tappets or "tongues". (Gerrard and Sharpe 1985, 206-7) Cams were wedged in place with a wooden peg, and tongues were inserted into attachments on the lifters. (*ibid.*)

Part of the stamps barrel from Wheal Prosper, for use with one set of four lifters is illustrated in Fig. 5:30. On the barrel, at the position of each lifter are five cam sockets, rectangular in section and placed opposite a "knock-out hole" of conical section. (Gerrard and Sharpe 1985, 206) As the wheel turned, the cams, wedged in the cam sockets, engaged the tongues inserted in the lifters, and the lifter could be raised about 10 inches and allowed to fall on the ore below. (Cook *et al* 1974, 185) According to the design of the barrel it would be possible to cause the lifters to fall in a particular sequence. Thus the arrangement

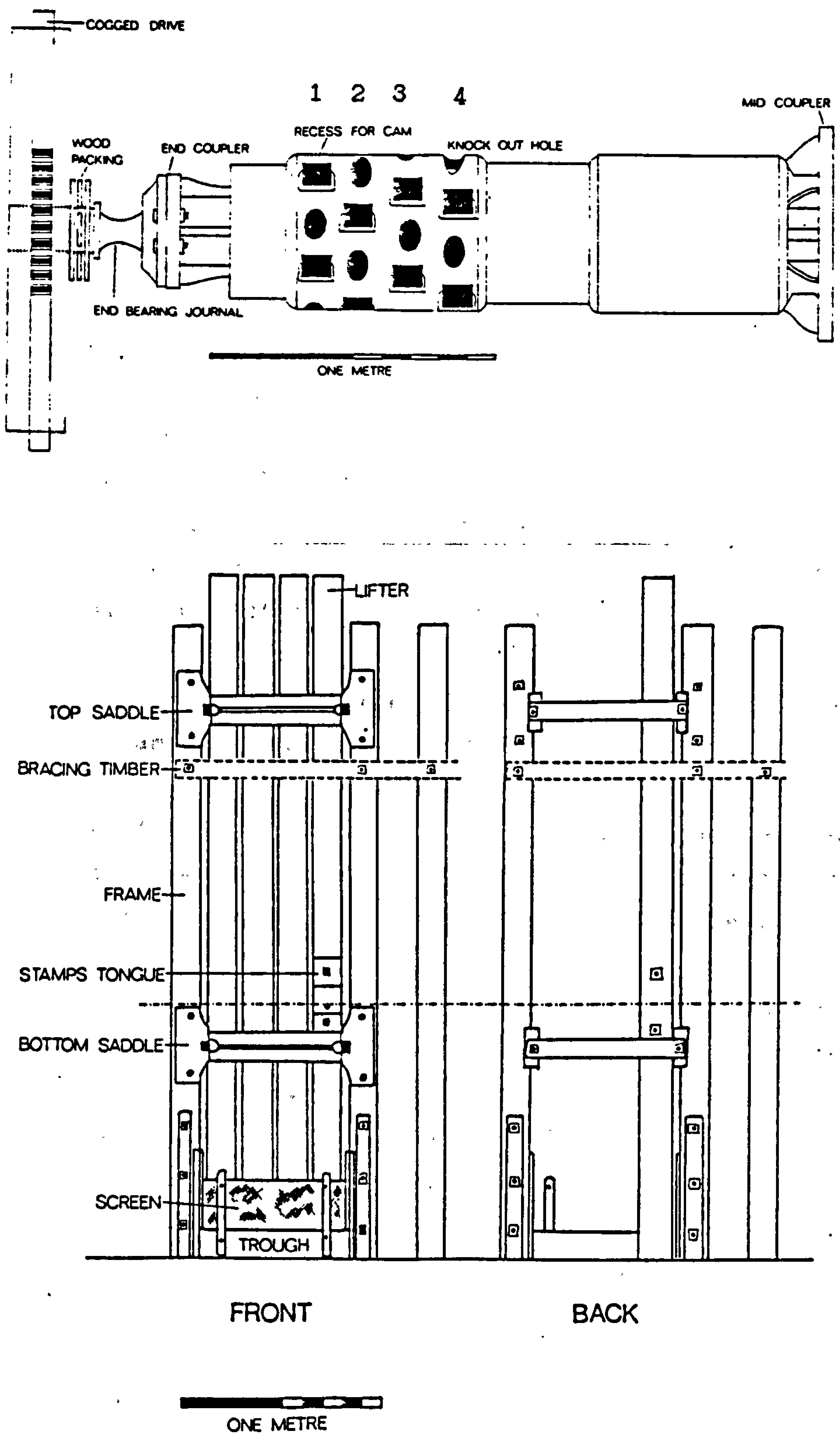


Fig. 5:30 Stamping machinery, from Wheal Prosper, Lanivet (from Gerrard and Sharpe 1985, figs 8 and 9)

of cam sockets on the Wheal Prosper barrel indicates that lifter 2 was raised first, followed by lifter 4, then 3 and lastly 1. (See Fig. 5:30) It may have been possible to arrange the cam sockets in a shallow diagonal line so that lifters could be raised in a regular sequence from left to right.

UPV Field Evidence

Although the machinery is no longer *in situ*, some inferences can be made from the surviving structures. At all seven of the dressing floors, the wheel pit for the stamping mill is clearly defined. (Figs. 5:31 - 5:34 & Plates 5:14 - 5:17) These pits indicate the use of wheels ranging from 12ft to 20ft (3.66m - 6.10m) in diameter and 2ft to 3ft (0.61m - 0.91m) abreast. (See Table 5:5) The 17ft wheel sold in 1852 could have been erected at **Mons 1093, 1091** or **1066**, but these may not have accomodated six heads of stamps. Therefore it is possible that stamping during the late 1840's was undertaken at **Mons 1064** or **1185**, which had coffers for two sets of stamps as well as long enough wheel pits.

On the sites containing a single set of stamps, the stamping mill is located at the upper corner of the dressing floor. The wheel was supported on the inner side by a solidly-built wall, while a sloping grass- or heather-covered bank, occasionally with some stone lining visible, usually marks the outer side of the pit. In the best-preserved example, **Mon 1093**, this wall survives to a height of 2.50m and reveals the square aperture, through which the axle passed to connect to the stamps barrel on the other side. (See Plate 5:14) A wall of similar height may have existed on the other sites, though there is no evidence that this supported a roof. Cook, Greeves and Kilvington suggest that the wall was simply a free-standing screen to protect the stamps and workforce from spray. (1974, 187-8)

On the other side of this wall in varying degrees of preservation is the mortar box or coffer, defined by granite masonry. The absence of mortarstones is the main distinction between the 19th century and early mills in UPV. The mortarstones at the stamping mill in the Deancombe Valley are probably survivals of the earlier use of this site. (Greeves 1969, 200)

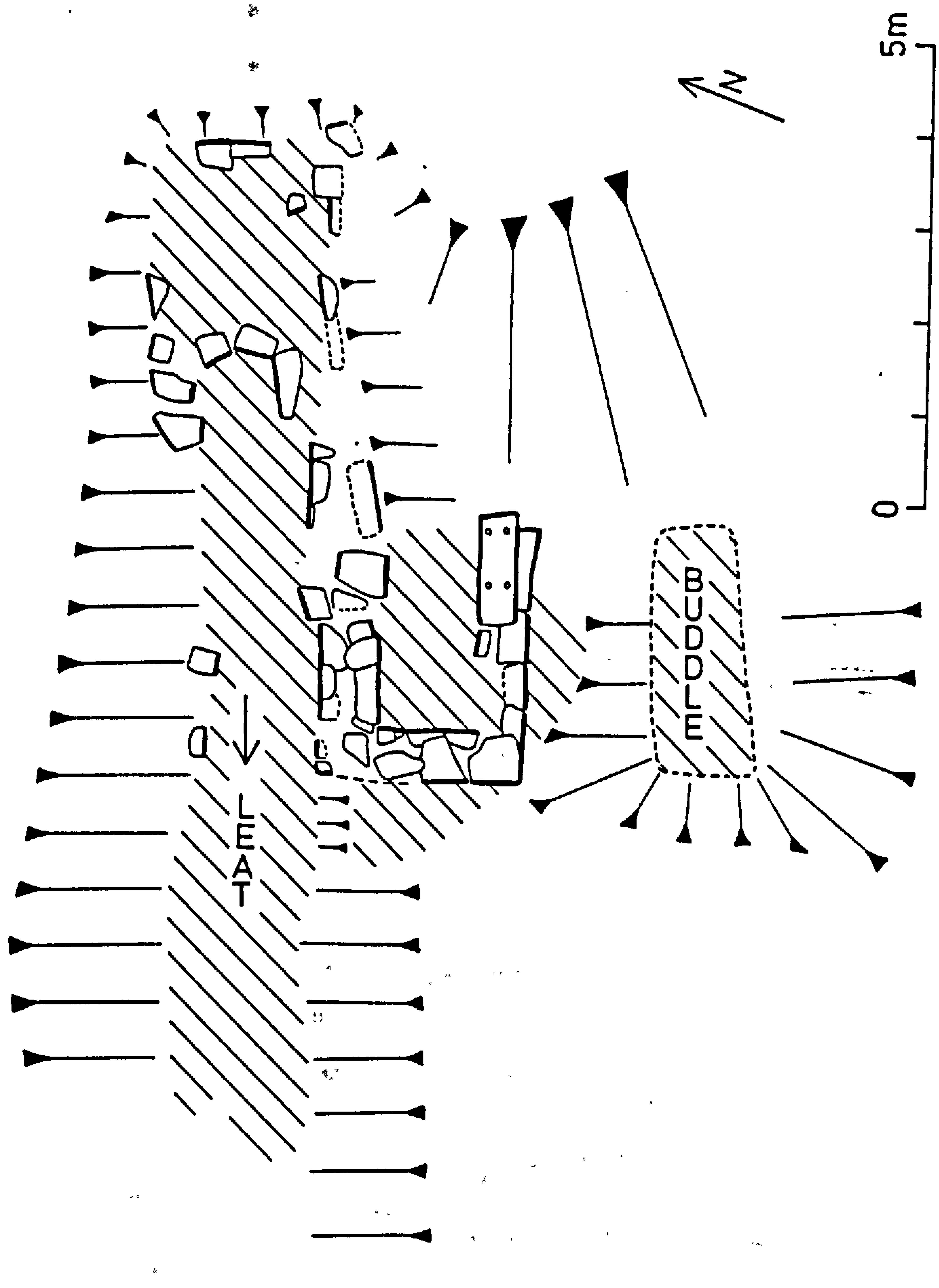


Fig. 5:31 Stamping mill, Mon 1094.

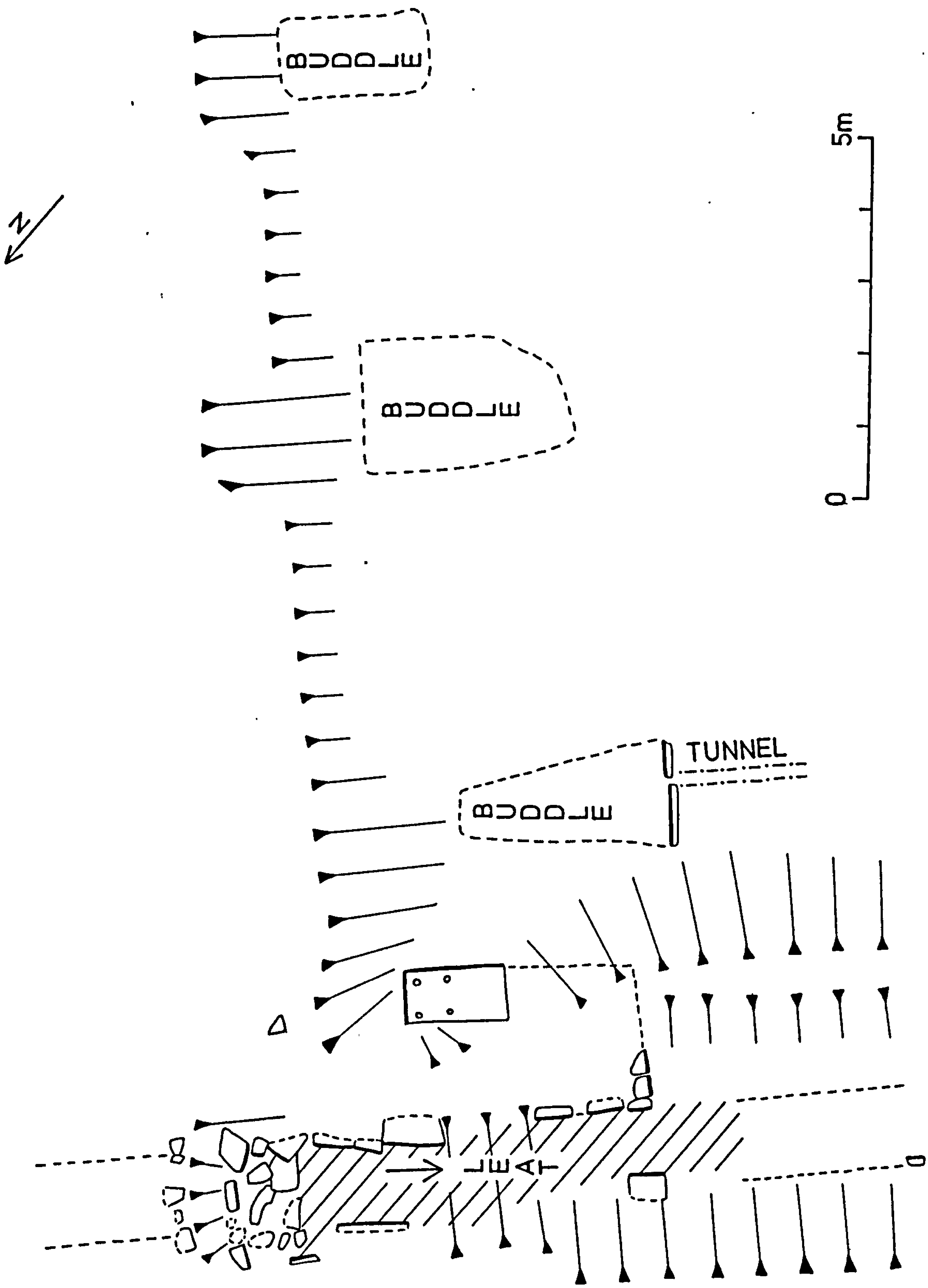


Fig. 5:32 Stamping mill, Mon 1091

Fig. 5:33 Stamping mill and smelting house, Mon 1066

Fig. 5:34 Stamping mill, Mon 1064

Plate 5:14 Stamping mill, **Mon 1093**

Plate 5:15 Stamping mill, **Mon 1094**

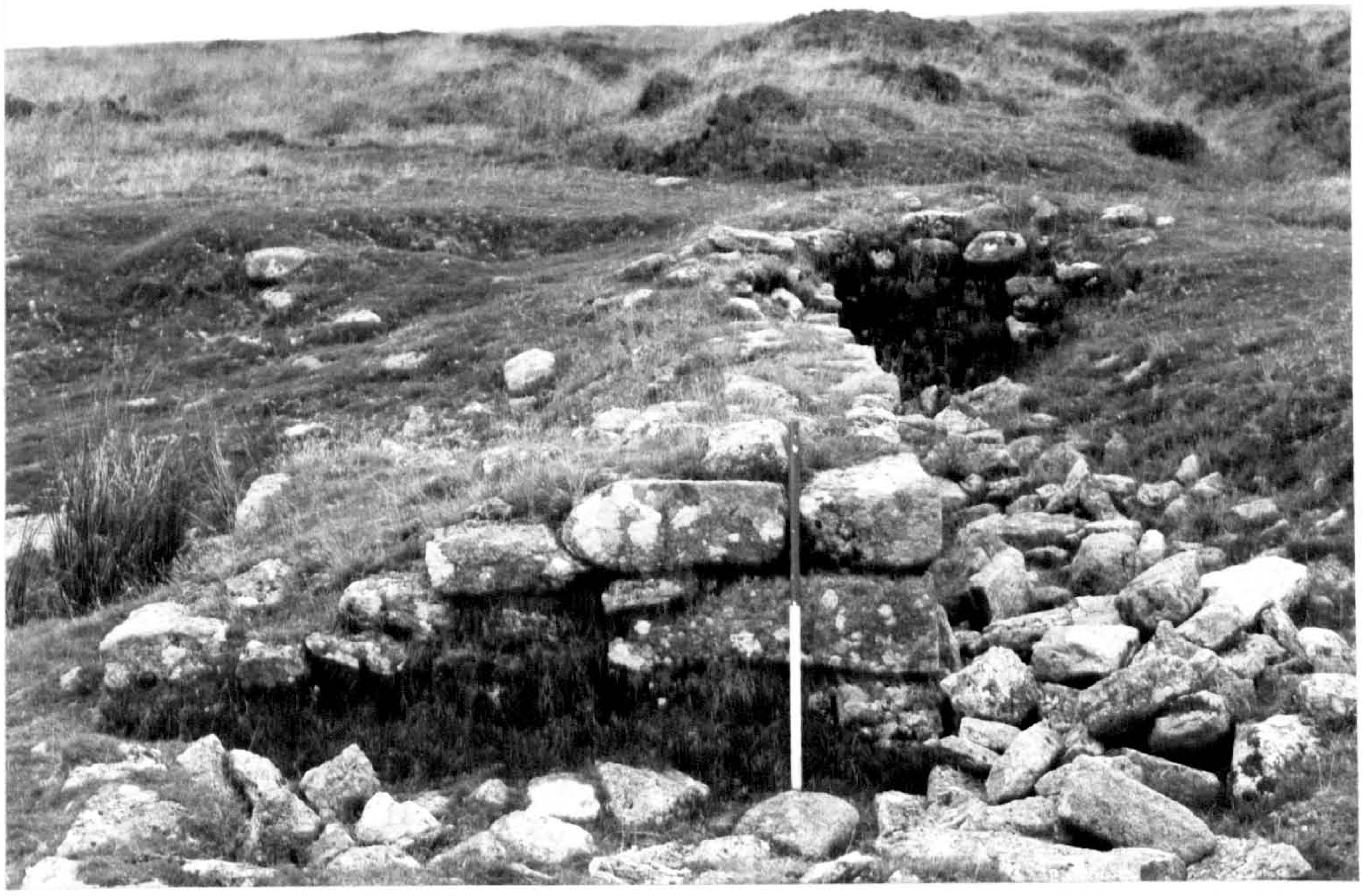


Plate 5:16 Stamping mill, Mon 1070

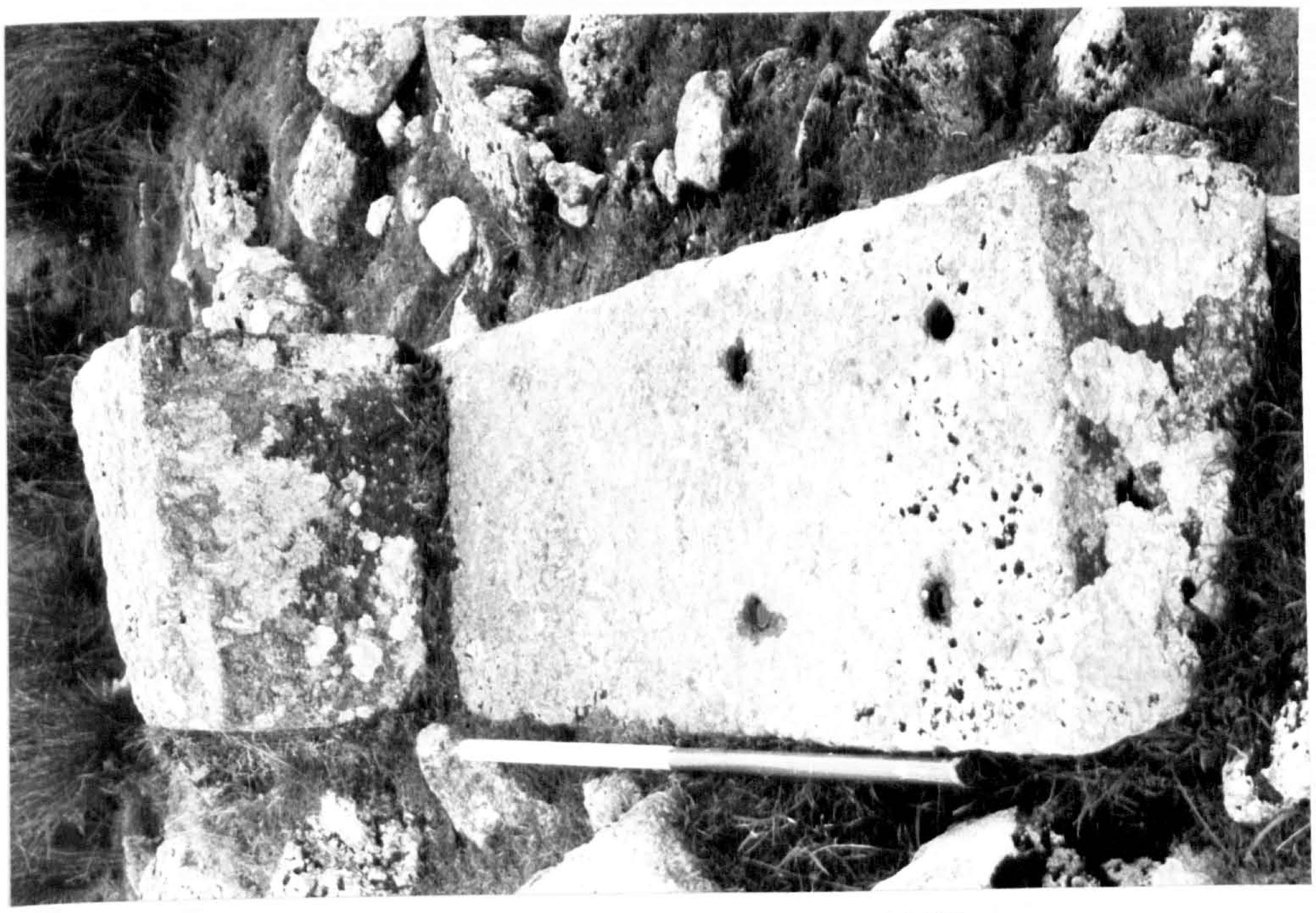


Plate 5:17 Stamping mill, Mon 1185

Cook, Greeves and Kilvington suggest that ore was crushed within these solidly-built coffers on a bed of coarse sand and gravel consisting of mostly quartz and feldspar. (1974, 187) Excavation of a mortar box at Wheal Prosper, near Bodmin, revealed that scrap iron was mixed with rammed quartz to form the crushing bed. (Gerrard and Sharpe 1985, 203-5, 209) Most of the UPV coffers are now dilapidated and rubble-filled but the most clearly defined example, at **Mon 1094** has an internal width of 1m. Cook, Greeves and Kilvington suggest that the width of the Eylesbarrow coffers would not have accomodated more than four lifters. (1974, 187) (See Table 5:5) At the double stamping mill, **Mon 1185**, the NW coffer is wider, and may have accomodated more lifters than the SE coffer.

At **Mons 1094, 1091, 1064** and **1185**, a large granite block drilled with four holes, forming the four corners of a rectangle, survives *in situ* on the far side of the coffer on the proposed line of the axle and stamps barrel. (See Plates 5:15 and 5:17) These blocks would have supported the bearing, which held the outer end of the stamps barrel.

A practice common in the 18th and 19th centuries and recommended by Agricola, was to set a metal grate, about 1ft square, 1/10th inch thick and perforated with holes the size of a "moderate pin", in one side of the mortar box, so that ore could not escape from the box until sufficiently reduced in size. (Borlase 1758, 178; Earl 1968, 77; Agricola 1950 ed., 312) A grate set vertically at one end could take advantage of a regular sequence of falling lifters so that ore would automatically be pushed in the direction of and eventually through the grate. (Cook *et al* 1974, 185) Then crushed ore could be sluiced directly into a settling pit without the necessity of shovelling it out manually. At Eylesbarrow, most of the coffers seem to have been open only on the upper side; a good example is seen at **Mon 1094**. (See Fig.5:31 and Plate 5:15) However, exit of ore on the upper side is perhaps unlikely; in each case the stamps would have been situated at the upper end and it seems reasonable to assume that crushed ore would be pushed down into the body of the coffer. The upper end is more likely to be the entrance to the coffer, into which uncrushed ore was shovelled or allowed to slide down a wooden "ore pass", (Borlase 1758, 178) However, there is no trace of any opening in the lower end of the coffers. (eg. Plate 5:16)

c) Concentration

Methods of concentration adopted in the 18th century, described by Borlase in 1758 and Pryce in 1778, probably bear close resemblance to the procedure followed at Eylesbarrow. Concentration follows the same principles of elutriation exploited in early crushing mills and in tin streamworks, but by the 18th century had evolved into a system of several stages of refinement. Fig. 5:35 illustrates a typical 18th century and probably 19th century dressing floor and Fig. 5:36 summarizes the procedure.

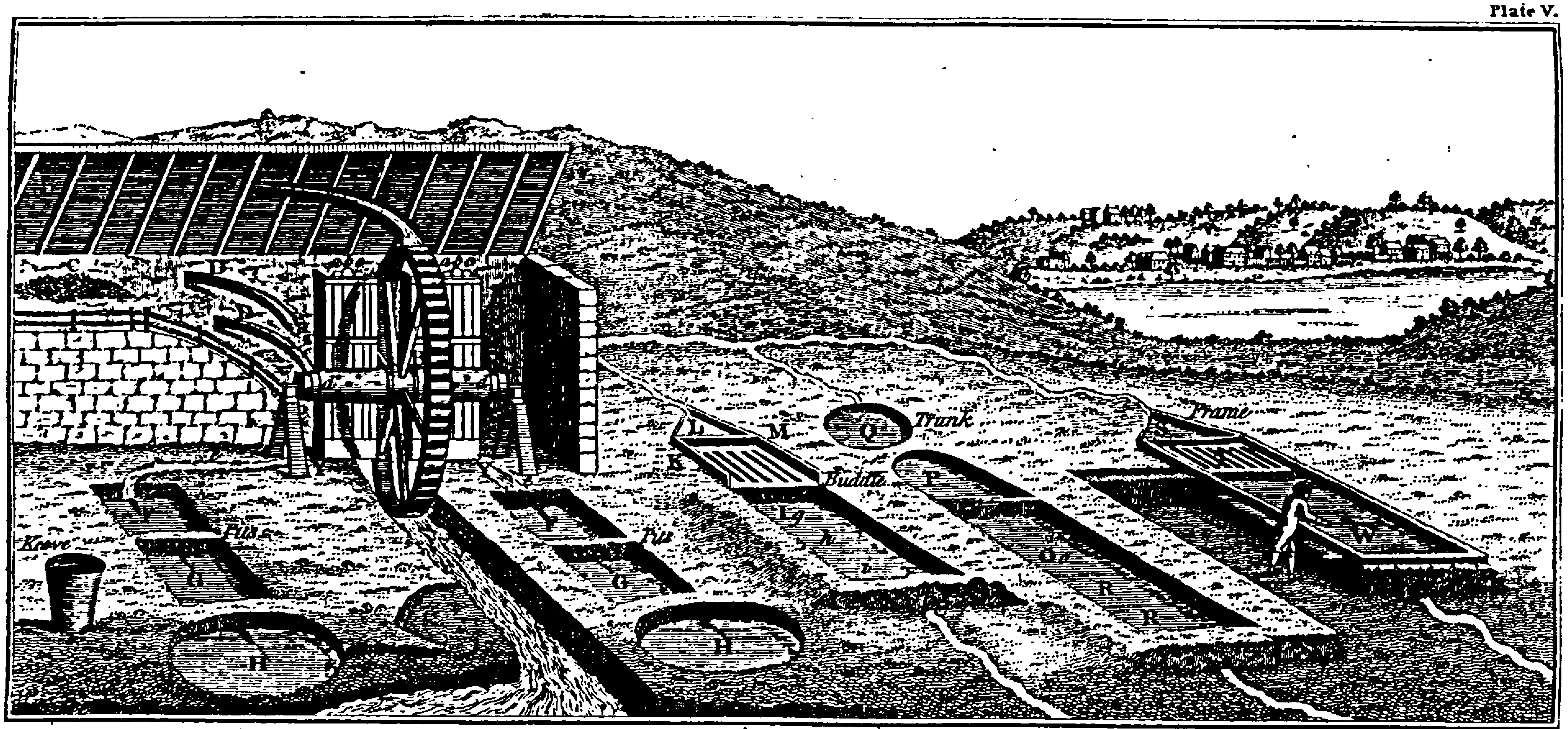
1. After stamping, crushed ore was taken to a line of three interconnecting pits, marked F,G and H on Fig. 5:35. In a gentle flow of water, taken from the tailrace of the stamps' wheel, the denser tin ore settled in the upper pit, F, while less pure slimes flowed into the second and third pits, G and H. (Borlase 1758, 178) The flow of water carrying worthless waste returned to the tailrace. (*ibid.*) As in all stages of refinement, material settling in the upper pit proceeded to a different treatment from the accumulation in the lower pit.

2. The contents of pit, F, were taken to a buddle, I, which was a pit, 7ft long, 2ft wide and 2ft deep. (*ibid.*) Ore was spread out at the head, K, on a "jagging board", in ridges parallel to the direction of a flow of water, introduced at L. (*ibid.*; Earl 1968, 77) The dresser agitated these ridges with a shovel, while also stirring ore in the buddle with his feet, to help the water wash away impurities. (Borlase 1758, 178) Eventually ore would settle in the buddle according to purity, from the highest grade called the "head" at the "fore-part", g, to the lowest grade or "tails" at the bottom, i. The middle part could be divided into "first middle heads" and "second middle heads". (*ibid.*; Earl 1968, 77-8)

The head then received its final treatment, called "tozing" or "tossing" in a large tub, known as a "kieve" or "keeve"; the ore was stirred in water for about 15 minutes allowing impurities to rise to the surface. A few hammer blows on the side of the kieve encouraged purer ore to settle on the bottom, so that the contents could be graded.

> "The "sordes" which settles above the tin is skimmed off, and what remains is pure enough to be sent to the melting house, and is then called Black Tin."
> (Borlase 1758, 179)

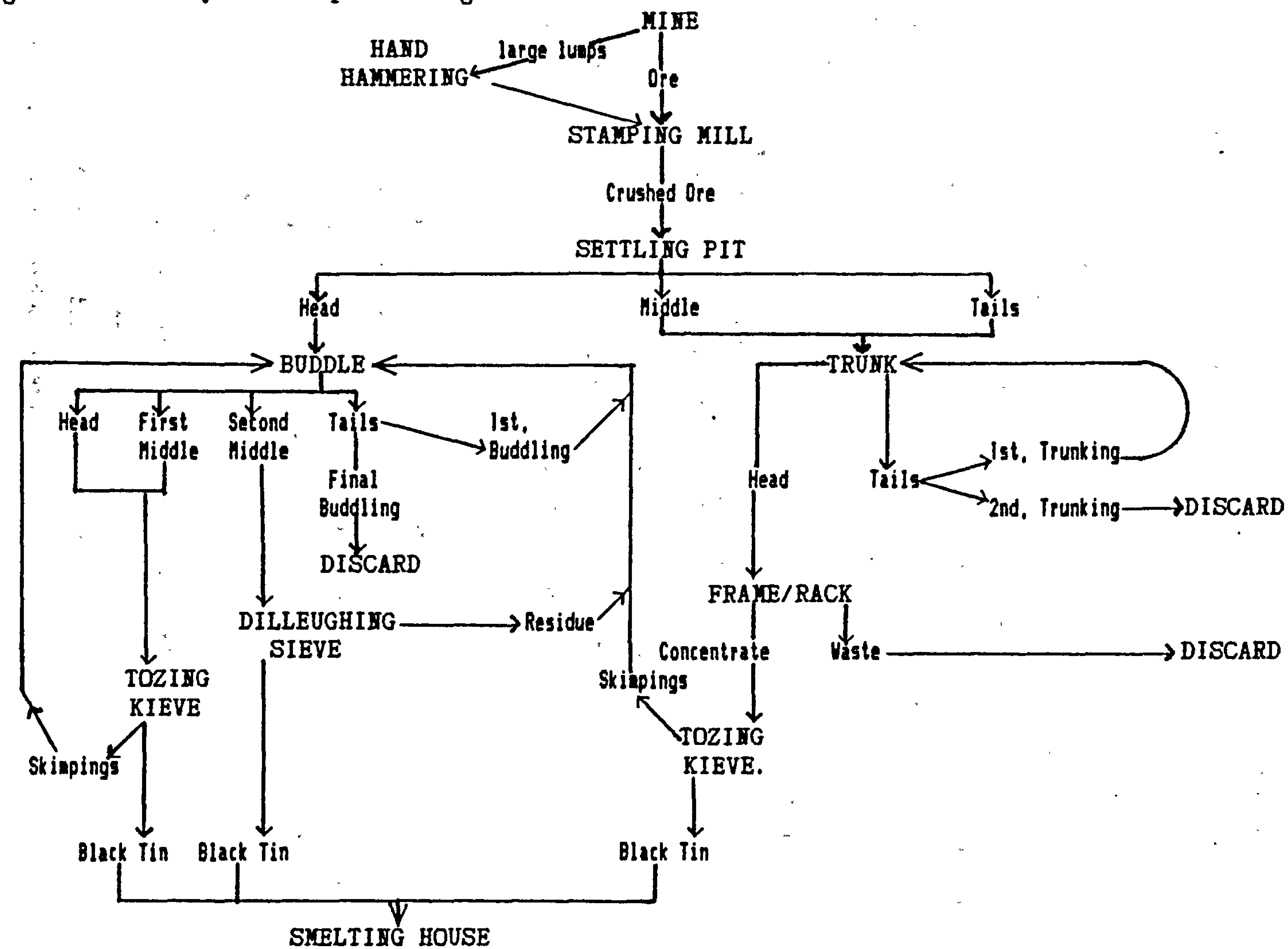
Plate V.



To the Right Hon.ble Humphry Morice M.P.
Lord Warden of the Stannaries and Steward of the Dutchy of Cornwall.
This Plate Engraved at his Expence is most gratefully Inscribed by
W.m Pryce.

Fig. 5:35 18th century dressing floor
(from Pryce 1778 Plate V)

Fig. 5:36 Summary of tin processing



Variations could of course occur; the pure ore in the bottom of the kieve could be re-buddled to concentrate even further, before a second tozing. (Earl 1968, 78) In the 19th century, the practice of "chimming" was introduced, in which the kieve was inclined at an angle of about 30°, which produced a cleaner separation between the purer ore and the "sordes", or "skimpings". (*ibid.*)

The lower grade tin from the buddle, that settling at h and i, may then have been re-buddled until settled at the fore-part, as Borlase suggested, or this material may again have been treated separately according to grade. (1758, 179) In this case, the first middle heads could be tozed, while the second middle heads underwent "dilleughing". (Earl 1968, 78) In this process, a coarse sieve and about 30lbs of ore was placed into a kieve, 2/3 full of water.

> "The sieve was then moved round and round and up and down, and from side to side, so that the small and light particles became suspended in the water, and by inclining the sieve were allowed to pass out and settle to the bottom of the kieve, the heavy tin remaining on the mesh."
> (Earl 1968, 78)

The skimpings from the tozing kieves, the residue in the bottom of the dilleughing kieves, and probably the tails from the buddle, were then re-buddled until more tin settled at the head. (*ibid.*)

3. A third stage of refinement was designed for the treatment of slimes from the lower pits, G and H, in the initial settling process. Slimes were taken to the "trunk" and stirred with a shovel in the semi-circular head, called the "pednam", P, so that water issuing from Q would wash tin and waste over a cross-board into the main part of the trunk. (Borlase 1758, 179) This was lined with boards and measured 10ft long, 3ft wide and 8 inches deep. Once again, ore settled according to grade; the poorer tails at R were re-trunked and the head proceeded to the next stage, the "frame". (*ibid.*) The tails, which accumulated after a second trunking were discarded. (Earl 1968, 78)

4. A further process for the concentration of the finest grains of ore was carried out on a "frame" or "rack". This consisted of a swivelling board, marked W on Fig. 5:35, which was supported on two pivots or "melliers" and at first fixed in a "nearly horizontal" plane. (Borlase

1758, 179) Ore placed in ridges at the head, T, was washed slowly onto the board and stirred in a very gentle flow of water allowing light waste to be carried away. (*ibid.*) "The gentle flow, together with the large area of the frame, provided conditions where the fine tin could deposit and make a concentrate." (Earl 1968, 79) When the tin was sufficiently concentrated, the frame was tipped up on the pivots, to deposit the tin in a wooden chest or coffer. (Borlase 1758, 179-180) The contents of the coffer could be tozed in a kieve, re-treated on the frame and tozed again before attaining a sufficient degree of purity.

When a batch of ore had finally gone through these processes, it was ready for smelting and known as black tin. Borlase calculated that one man and five boys could process 100 sacks of ore (12 gallons each) at 6d per sack in a few days. (1758, 181) The procedures described by Borlase and Pryce may have been standard practice, but undoubtedly local adaptations were introduced to treat particular grades of ore. Thus:

> "They vary their operations inconceivably, conducting with great ingenuity, lessening, increasing, diffusing, or contracting their water ... as the size, weight, and combinations of the metal and its feeders do require." (Borlase 1758, 180)

UPV Field Evidence

Field evidence survives at Eylesbarrow for most of these processes.

i) Settling Pits

It is likely that the large rectangular or trapezoidal pits situated in the lower parts of the dressing floors, were used for the initial settling process. While such a process might be expected to take place near the stamps as depicted in Fig. 5:35, the layout of the floors probably varied widely and could depend on local preferences. At Eylesbarrow the upper side of the floors were reserved for buddles which used the rear wall to support the jagging boards, though the location of settling pits at the far end of the floors may have necessitated considerable man-handling of ore to carry the concentrates from the settling pits to the buddles. These pits are found singly, or arranged end to end in pairs or threes. Details are summarised in Table 5:6.

Table 5:6 Eylesbarrow Dressing Floors: Settling Pits.

FLOOR	SETTLING PIT	DIMENSIONS Metres LONGxWIDExDEEP	REMARKS
Mon 1094	Single Pit	1) 6.4 x2.4	A Narrow channel is visible on the surface for 2.80m eastwards to a stone step, where water supply may have originally issued from an underground channel. Parallel and 1m to the N. of a pair of pits.
	Pair of Pits End to End	2)Upper 6.8 x2.0 3)Lower 3.0 x2.4	Pits are connected by a short ditch visible on the surface. Lower pit drains into the immediately adjacent tailrace from Stamps.
Mon 1093	SE pair of pits End to End	1)Upper 5.2 x1.8 2)Lower 6.4 x1.8	Stone-lining of lower pit is well-preserved. Stone-lining partly survives in water supply channel, which is visible for 4.6m to the N. Pits are connected by a short ditch visible on the surface.
	SW pair of pits	3)Upper 5.0 x2.4 4)Lower 7.4 x2.4	Pits are not in direct alignment and are not connected on the surface, and probably not underground Channel 7.2m long, brought water supply to lower pit from the channel (visible on the surface for 5.6m) supplying water to the upper pit.
Mon 1091	Single Pit	1) 9.0 x4.0 x1.0	Subdivided by earthen partition,2.2m from upper end.Two narrow channels supply water into both compartments directly from Stamping Mill Leat. This may be a 'trunk'.
	Single Pit	2) 4.0 x2.0	1.0m W. and parallel of pit 1.
Mon 1070	Pair of Pits Adjacent to Stamps	1)Upper 3.0 x1.1 2)Lower 4.0 x2.0	Stone-lining of upper pit is well preserved. Connected by short ditch into trapezoidal lower pit. Another outflow from upper pit drains underground below a stone lintel, and probably continues into buddle tailrace.
	Single Pit	3) 5.0 x2.6	Large rectangular pit. No evidence of a water channel but recess at N. end may mark entrance of underground water supply.
	Three pits	4)Upper 4.8 x2.0 x.4 5)Mid 4.4 x2.4 x.4 6)Lower 6.0 x2.0 x.4	3 pits possibly connected underground.No connecting ditches are visible on surface. Water supply to upper pit, is visible on the surface for 5m. Stone step is visible along this channel, and at entrance to upper pit.

Table 5:6 (Continued) Eylesbarrow Dressing Floors: Settling Pits.

FLOOR	SETTLING PIT	DIMENSIONS Metres LONGxWIDExDEEP	REMARKS
Mon 1066			
Mon 1064	S.Pair of pits End to End	1)Upper 7.0 x4.0 x.3 2)lower 4.0 x4.0 x.3	2 pits, not connected on the surface. A channel is visible on the surface for 13m, N.W. of the upper pit, but water may have been brought underground from the tail race from buddle 8. An outflow is visible in the tailrace between buddles 7 and 8.
	Mid Pair of pits	3)S.W. 9.0 x3.5 x.3 4)N.E. 7.5 x3.5 x.3	Pits are parallel and not connected on the surface. A channel is visible on the surface supplying water to pit No.4. A branch 0.8m deep, 10.5m long, collecting drainage from buddle 4, and probably from Stamp's tailrace, joins a channel 0.8m deep, 23.5m long, collecting drainage from buddles 6,7,and 8 to form water supply.
	N. Single Pit	5) 6.0 x3.0 x.3	A channel is visible on the surface, 25m long, which probably collected drainage from buddles No. 2 and No. 1, and supplied water to pit. Water supply probably also from Drizzle Combe.
Mon 1070	W.Single pit	1) 6.0 x5.0	Near its N end this pit lets water into adjacent large pit, though this would not appear to allow material to flow from one to the other. Water supply is from Engine Leat. Mon 1075
	Mid Single Pit	2) 12.0 x3.0	Water supplied from pit No. 1. (See above)
	E.Single pit	3) 5.0 x4.0	Water is supplied from Engine Leat, Mon 1075, through a surface channel 25m long.

The pairs and trios of pits arranged end to end follow the standard pattern of settling pits as illustrated in Fig. 5:35, in which ore settled according to grade. The function of single pits may have been different. Grading the range of particle size of ore straight from the stamps might not be possible in a single pit. Furthermore, the presence of these pits on floors also containing double or triple pits suggests that single pits had a different purpose. A single pit could have been used simply for concentration, rather than grading; thus material from the stamps could be dumped in the pit allowing excess water to soak away through the earthen floor. However, this would not explain the presence on some floors (pit 1 at **Mon 1094**, pits 4 and 5 at **Mon 1064**, and possibly pit 3 at **Mon 1070**) of a water supply channel, suggesting that a flow of water was involved for washing and therefore grading. The proximity of single pits to a pair of pits, notably on floor, **Mon 1094**, suggests that the processes are closely related. It is possible that a single pit with a water supply was used for a more refined grading, for example of the heads or middle heads, after preliminary grading in the pair of pits. The possibility remains that pits without water supply or drainage outlets, such as pit 2 at **Mon 1091**, and pit 3 at **Mon 1064**, were used as soakaways.

On floor, **Mon 1093**, pits 3 and 4 are arranged as if in a pair, but they do not seem to be connected and are not in alignment as pits 1 and 2. Individual water supply is provided for both and therefore these two pits are probably single pits similar to those on other floors. On floor, **Mon 1185**, single pits are the only type of settling pits recorded. However, here the particularly long central pit may have sufficed for grading ore. The long water channel leading to pit 3 may even have been used.

Pit 1, next to the stamps, on floor **Mon 1070**, in a position occupied by a buddle on other floors, seems to be more like a settling pit than a buddle. Firstly, there is no provision for a jagging board as it lies some distance from the rear wall, though a prop of wood or stone could have been removed. Furthermore this pit drains into a large trapezoidal settling pit, similar to the usual arrangement of settling pits. The second outflow underground below a stone lintel may be appropriate for a buddle or a settling pit.

ii) Buddles

Buddles are perhaps the most identifiable feature of the concentration processes at Eylesbarrow. (See Table 5:7) A row of three or four is found along the rear wall of each dressing floor. Many are now just visible as shallow grassy depressions, but may have had, or still have a stone lining, such as those which are particularly well-preserved in buddles 1 and 2 on floor, **Mon 1093** and buddle 1 at **Mon 1091**. (see plates 5:18 and 5:19) A particularly striking example is the E buddle at floor, **Mon 1070**, in which a single edge set slab flanks each side. The "buddles" listed in the 1852 advertisement for the sale of equipment from Eylesbarrow may have been removeable wooden linings, but they may simply refer to jagging boards. (MJ 25.9.1852) All are now partly filled with waste but Cook, Greeves and Kilvington suggest that depth may have been an average of about 0.61m (2ft), though buddle 4 at **Mon 1064** is presently 0.90m deep. (1974, 191)

The buddles seem to have been designed with great precision. They are arranged at various distances from the rear wall, which Cook, Greeves and Kilvington suggest was to allow the jagging board to be inclined at different angles to allow greater or less refinement in grading. (1974, 191) This is particularly well-demonstrated on floor, **Mon 1094**, where the head of the buddles are 2.60m, 0.30m and 1.10m from the rear wall.

Earthen mounds built against the wall, which supported the jagging boards are clearly visible on floors. **Mons 1093, 1091** and **1070**. Mounds may also have been provided on floors, **Mons 1064** and **1066**, but are difficult to detect as the rear wall on these floors is not clearly defined. Similarly, on floor, **Mon 1094**, the rear wall is very overgrown, though slight protrusions are perceptible. At **Mon 1185**, the masonry - lined wall is well-preserved and there is no trace of mounds. However, it is possible that the three mounds built on top of the wall above buddles 3 and 4 were an alternative arrangement. Buddle 2 at **Mon 1185** and buddle 9 at **Mon 1064**, reveal a further variation; in both cases a recess has been built into the rear wall opposite the buddle, possibly to allow a more gentle inclination of the board.

Table 5:7 Eylesbarrow Dressing Floors; Buddles.

FLOOR	BUDDLE	DIMENSIONS(metres) long x wide x deep	REMARKS
Mon 1094	1 From NW End	2.6m x 2.0m	Grassy Depression. 2.60m from rear wall
	2 " " "	3.6m x 2.2m	Grassy Depression. 0.30m from rear wall
	3 " " "	2.0m x .75m	Grassy Depression. 1.10m from rear wall
Mon 1093	1 From NW End	3.2m x 1.0m x 0.3m	Stone-lined, Outflow undergound between 2 stone slabs. 2.2m from masonry-lined wall Mound to one side against wall, may have been for jagging board.
	2 " " "	2.0m x 1.0m	Stone lined. Outflow underground between 2 stone slabs 0.90m from a mound against rear wall.
	3 " " "	1.8m x 1.0m	Shallow grassy depression. 0.10m from mound against rear wall.
	4 " " "	1.6m x 1.0m	Shallow grassy depression. 0.10m from mound against rear wall.
Mon 1091	1 " " "	2.8m x 1.45mx 0.8m	Trapezoidal and stone-lined; outflow underground between 2 large stone slabs; 1.10m from mound against rear wall, slightly to one side.
	2 " " "	2.2m x 0.8m x -	Barely perceptible: 0.05m from mound against rear wall.
	3 " " "	2.75mx 1.8m x 0.1m	Shallow grassy depression: 0.20m from mound against rear wall.
	4 " " "	2.0m x 1.05mx 0.1m	Shallow grassy depression: 0.05m from mound against rear wall.
Mon 1090	1 From E End	1.2m x 0.5m	Each side is lined by a single edge-set slab; 0.05m from a mound. Drains through surface channel 4.0m long, into a tailrace. Visible on surface for 11.40m, which also collects drainage from buddle No. 2.
	2	2.4m x 1.0m x .45m	Grassy depression; 0.10m from a mound against rear wall. Drains through surface channel, 1.10m long into a tailrace. Visible on the surface for 11.40m, which also collects drainage from buddle No. 1.
Mon 1066	1 From NE End	3.2m x 0.7m x 0.6m	Stone-lined; outflow underground between stone slabs. Large block has fallen in, probably from stamps' coffer.
	2 " " "	2.0m x 1.0m	Shallow grassy depression.

Table 5:7 (Continued) Eylesbarrow Dressing Floors: Buddles.

FLOOR	BUDDLE	DIMENSIONS(metres) long x wide x deep	REMARKS
Mon 1064	1 From NE End	3.0m x 1.0m x 0.2m	Grassy depression; 2.0m from rear wall. May drain partly underground into surface gully which eventually supplies settling pit No. 5.
	2 " " "	2.0m x 0.3m	Grassy depression; 3.0m from rear wall. May drain partly underground into surface gully which eventually supplies settling pit No. 5.
	3 " " "	3.0m x 0.3m x 0.4m	Grassy depression; 2.0m from rear wall.
	4 " " "	3.2m x 1.0m x 0.9m	Stone-lined, 5.0m from rear wall. Outflow underground between stone slabs. A groove, probably to contain sluice gate is visible in 1 slab.
	5 " " "	3.2m x 1.6m x 0.8m	Stone-lined, trapezoidal; 4.50m from rear wall. Outflow underground between 2 stone slabs, in which vertical grooves were presumably designed to contain a sluice gate. The bearing block from the SW coffer has fallen in.
	6 " " "	3.0m x 0.5m	Grassy depression: 1.50m from rear wall.
	7 " " "	3.0m x 1.0m x 0.4m	Grassy depression, 1.50m from rear wall. Buddles 5-7 drained partly underground into surface channel which eventually supplies settling pit No. 4.
	8 " " "	3.0m x 1.0m x 0.6m	Grassy depression, 1.0m from rear wall. Drains on surface into channel which eventually supplies settling pit No. 4.
Mon 1064	Subsidary Floor 9 " " "	5.0m x 1.0m x 0.3m	Situated 1.0m from rear wall; recess in wall may have been designed to allow greater sloping of the jagging board. Another recess may relate to another buddle no longer visible.
	10 " " "	3.5m x 1.0m x 0.3m	Situated 1.0m from rear wall.
Mon 1185	1 From NW End	2.3m x .65m x 0.5m	Stone-lined: 1.30m from rear wall.
	2 " " "	2.9m x 0.4m x 0.2m	Stone-lined: 2.0m from rear wall Opposite a stone-lined recess set into wall for 1.10m
	3 " " "	2.2m x 0.9m x 0.5m	Stone-lined; 1.2m from rear wall. A channel 0.1m deep, in which stone lining is partly visible, running along top of embankment in line with buddle may have bought water supply.
	4 " " "	2.2m x .75m x .10m	Situated 1.40m from rear wall.

Plate 5:18 Buddle at stamping mill, **Mon 1093**

Plate 5:19 Buddle at stamping mill, **Mon 1091**

Dense heather cover on top of the rear walls makes it difficult to detect channels for water supply to the buddles. The partly stone-lined channel, running to the wall edge opposite buddle 3 on floor, **Mon 1185**, is the only example.

Careful use of water is apparent on all floors. Drainage from buddles and settling pits is collected in channels and returned to the main leat. Grates may have been inserted to prevent too much waste material from entering and choking the leat. These channels sometimes run on the surface, but presumably a wide network of ditches would obstruct work. Thus where a level surface was required, underground channels were preferable. A stone lining is still visible in the surface channel leading to settling pit 1 at **Mon 1093**, and was probably used underground. Excavation of the floors may reveal a complex system of underground conduits supplying water to some pits and collecting drainage from others, but a pattern still emerges from details visible on the surface. For example, buddles on floor, **Mon 1093**, drained directly underground; the outflow is still visible between two stones in buddles 1 and 2. On the same floor, the channel supplying water to settling pit 2 is visible on the surface for the final 4.60m. Presumably before this, it ran underground, possibly from the buddle drains. Underground outflows in buddles are also visible at buddle 1 on **Mon 1091**, buddle 1 on **Mon 1066** and buddles 4 and 5 on **Mon 1064**, but may have occurred at any buddle, which has no evidence for a surface channel.

On floor, **Mon 1070**, the two buddles drain through surface channels which run into a tailrace; after a distance of 11.40m this also disappears underground and probably continued into the main leat. The underground outflow, which is still visible in settling pit 1 probably joins this tail race.

The best example of reuse of water is at **Mon 1064**, where buddle 8 drains through a surface channel, which eventually supplies settling pit 4. The outflow from buddles 6 and 7 probably joined this channel after running underground for a short distance. Buddle 5 certainly drained underground at first; the opening for the outflow survives, revealing grooved stones which could have held a sluice gate. Presumably the gate opened to allow water to drain away, possibly through a grate. Cook, Greeves and Kilvington suggest that the sluice may have been designed to control the depth of water in the buddle or to regulate the flow of water through it. (1974, 191) The underground channel may have issued into another branch of the surface channel to pit 4. Another outflow is visible in this tailrace between buddles 7 and 8, which may have joined the surface channel supplying pit 1.

iii) Trunks

It is difficult to distinguish field evidence for the "trunk", Borlase and Pryce's third stage of processing, from the settling pits of the first stage. However it is possible that pit 1 at **Mon 1091** was used for this purpose. It differs from the other pits, consisting of one long, large pit, subdivided 2.20m from the top end by a low bank. This bank could correspond to the cross-board of the trunk. Two narrow channels, separated by a small mound, supply water directly from the Stamping Mill Leat, **Mon 1052**. This pit is situated some distance from the other features on this dressing floor and it is possible that it was deliberately constructed below the Stamping Mill Leat to take advantage of purer water. This might support its use for treating fine slimes.

iv) Frames or Racks

Field evidence for the frame might be difficult to identify in the absence of the swivelling board. However documentary evidence provides further clues for UPV. The Plan of Ellisborough Tin Mine marks "Reck Houses" at **Mons 1094, 1091, 1070** and **1066**. (WDRO WW21) The structure indicated at the floor, **Mon 1091**, W of the leat has not been located. However, enclosed, and possibly originally covered, pits have been identified at the positions indicated on the Plan for reck houses at **Mons 1070** and **1066**. A roof might accord well with the documentary evidence; their notation on the Plan suggests that they were structures rather than open pits. The distinguishing feature of both these structures is a split-level floor. At **Mon 1066i**, the W platform drops 0.40m to a smaller platform. (See Fig. 5:37) Water could have drained underground through a stone-lined outflow in the E lower compartment. At **Mon 1070f**, the SW platform also drops 0.40m to a smaller platform, where again a stone-lined outflow was provided for drainage. (See Fig. 5:37) This split-level floor could well have been designed to accomodate a swivelling board.

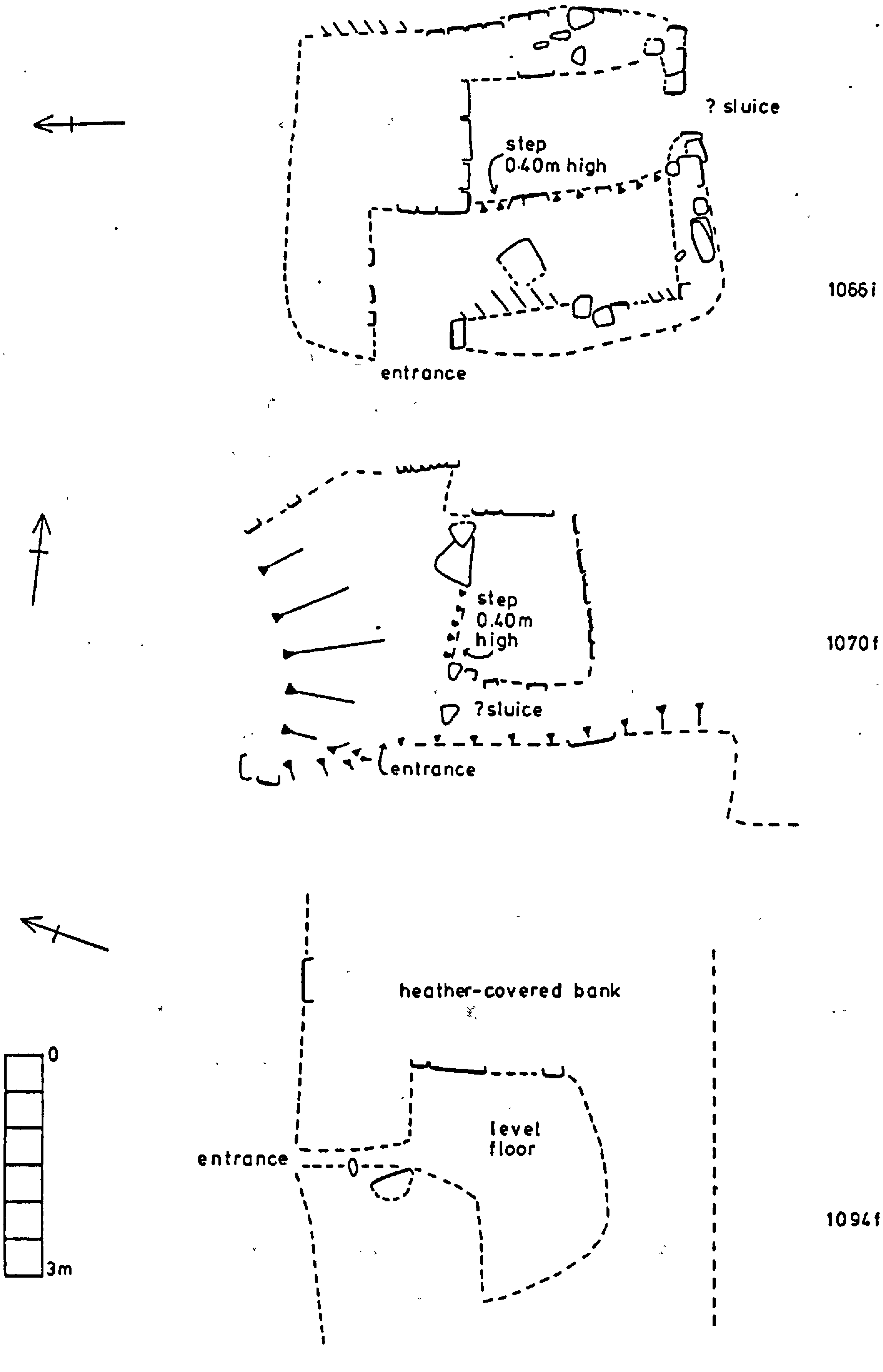


Fig. 5:37 Reck-houses, Mons 1066i, 1070f and 1094f

These pits are more enclosed than the frame illustrated by Pryce (See Fig. 5:35) but the amount of water at this stage of refinement may have been critical and extra measures may have been required to protect material from the elements on a windswept Dartmoor hill.

The reck house at **Mon 1094** is less easily identified. On the Plan of Ellisborough Tin Mine, it seems to be located outside the dressing floor. (WDRO WW21) This corresponds with the position of **Mon 1095**, but this structure bears no resemblance to the other reck houses. It seems to be more like a wheel-pit, though for no obvious purpose. It is possible that the recess in the lower corner of the retaining bank of the dressing floor, **Mon 1094**, is the reck house. No split-level floor is discernible but the recess is of similar dimensions and is divided into two unequal compartments as the other reck houses. (See Fig. 5:37) There are also two reck houses at Wheal Katherine.

v) Kieves and Sieves

Despite a lack of field evidence. tozing and dilleughing were almost certainly carried out at Eylesbarrow. "3 oak kieves" and "sieves" were advertised for sale in 1852. (MJ 25.9.1847)

vi) Finally there are some features, particularly at Wheal Katherine, which do not fit into the standard pattern of ore dressing.

a. In the SE part of dressing floor, **Mon 1185**, three stone-revetted recesses are inserted into the rear wall. These have narrow openings but widen into a curved back wall. They open into parallel shallow ditches, which are separated by grass-covered raised platforms. These were presumably used for grading ore, possibly in a similar way to buddles; the recess may have been designed to support a jagging board. Recesses are of graduating length, which may have permitted varying inclinations of the board.

b. The purpose of the fireplace, SE of the stamps at **Mon 1185**, is unclear. The presence of a chimney breast, *in situ* suggests that this is a simple fireplace rather than a furnace and a wooden structure may have surrounded it.

c. The Plan of Ellisborough Tin Mine marks two "dressing houses", one of which seems to correspond with **Mon 1188** in Wheal Katherine. (WDRO WW21) A recess in this structure may be a fireplace which suggests a domestic function, possibly a shelter, though its label "dressing house" may indicate an industrial purpose. The other dressing house "at the mouth of the deep Addit" was not located. (*ibid.*) It may have been destroyed when the 50ft wheel was erected in 1847.

5:8 SMELTING

5.8.1 The Development of Tin Smelting

The earliest smelting was probably executed in a simple bowl furnace, consisting of little more than a clay-lined pit, in which ore and peat were placed in layers. As an open wood or charcoal fire can reach 700° to 800° C (Rehder 1986, 87) only a few extra measures may have been sufficient to attain the 1000° C required for smelting tin. (Tylecote 1986, 43) Temperature could be raised by induced draught, either through a tuyere by hand- or foot-operated bellows or even by a natural blast of wind. (Pryce 1778, 281; Gowland 1899, 296) This method was probably sufficient for relatively high purity stream tin, though it required a heavy charge of fuel and probably lost much tin in volatilisation. (Pryce 1778, 281; Earl 1986, 17-8) On the evidence for double smelting in 12th century Devon and Cornwall (based on the imposition of a tax on the second stage), Worth suggested that the preliminary smelting may have taken place at the site of extraction. (1940c, 209) Field evidence of the bowl furnace has not been identified in Devon, but, in any case, is not likely to survive.

The development of the shaft, or blast furnace built above ground, allowed draught to be introduced near the base and enabled molten tin to trickle out, thereby undergoing further purification. (Earl 1986, 27) Enclosure of the furnace reduced the loss of ore in oxides and allowed greater control of the air supply. (Rehder 1986, 87) Proportionately less fuel was required, while higher temperatures could be reached, ensuring reduction of the whole charge. These furnaces, urged by water-powered bellows, were installed in Devon "blowing houses", from the 14th century, perhaps by 1303, when only one tax was levied on "white tin". (Lewis

1908, 137-8; Worth 1940, 210) A blowing house is documented on the R Plym in 1560, just outside the UPV area, at Brisworthy. (WDRO 72/1033) However, there is no evidence for blowing at the three early tin mills on the Upper Plym. (See above pp.474-477)

The shaft furnace was superceded by the reverbatory furnace after the first use of the latter for tin smelting in 1705 at Newham, Cornwall (Barton 1967, 20), but some blowing houses were still in use in the 18th and 19th centuries. (Hamilton Jenkin 1962, 72) The later examples, such as the blast furnace at Eylesbarrow Mine, **Mon 1066c**, may not have changed significantly in design from the Medieval furnaces.

Stream tin blown with charcoal in a shaft furnace produces very pure tin with little slag. (Tylecote 1986, 46) Both stream and lode tin were smelted in blowing houses, though in separate parcels, according to the detailed account given by Beare in 1586. (quoted in Greeves 1981, 249-50) However, 70% purity may still have been required in black tin from either source. (Earl 1986, 27) Greater reliance on low grade ores may have led to the adoption of the reverbatory furnace (described below), which could treat black tin of only 40% metal content, and could slag out impurities more precisely. (Earl 1986, 27) By the end of the 18th century, the blowing house may have been reserved for stream tin, while "mine tin" went to the reverbatory furnace. (Pryce 1778, 136) In Dartmoor, peat charcoal was plentiful, but the adoption of a coal-burning furnace may have been more imperative in Cornwall, where supplies of wood charcoal were under pressure. (Borlase 1758, 182; Pryce 1778, 282) Therefore reverbatory furnaces may have been adopted later in Dartmoor, but one was installed at Eylesbarrow in the 1820's. (Cook *et al* 1974, 165)

5.8.2 <u>Eylesbarrow Smelting House</u>

In view of the limited smelting facilities in Devon throughout the 18th century, the construction of a smelting house at Eylesbarrow was a significant development and indicates considerable optimism within the company. In 1689, only two smelting houses were operating in Devon, compared to 26 in Cornwall. (Barton 1967, 20) In 1730, again only two smelting houses were working in Devon (Greeves 1981, 41) and, in 1808, none at all. (Hamilton Jenkin 1962, 71-2) Possibly by the 1820's the cost of transporting ore to Cornwall outweighed the cost of building and operating a smelter. The Eylesbarrow shareholders may have had a further aim, namely to capture the local market, though at the time there were said to be only three large-scale mines working on Dartmoor. However, in 1825, nearly nine tons of ore were sold to "Ailsboro House" from Bottle Hill Mine, presumably for smelting but possibly also, as Cook, Greeves and Kilvington suggest, for dressing. (WDRO 72/1036; Cook *et al* 1974, 190) Furthermore, a reference to "the tin you have been sending to Ailsboro Smelting House" in a letter to the manager of Birch Tor Mine in 1826 indicates that the latter mine also used the local smelter. (Hamilton Jenkin 1974, 102) Even in 1847, when the smelter had been closed for 16 years, it was said to be capable of smelting all the tin in Devon. (MJ 5.6.1847)

"Ailsborough Smelting House" began operating in 1822 under the supervision of the smelter, Walter Wellington. (Cook *et al* 1974, 166) (see Fig. 5:33) Between Sept. 1822 and Dec. 1831, 1807 blocks of tin, amounting to about 276 tons, valued, as calculated by Cook, Greeves and Kilvington, at about £30,000 were coined at Tavistock. (1974, 166, App. B) Field and documentary evidence indicate that a shaft or blast furnace and a reverbatory furnace were used at Eylesbarrow. The operation of both types in conjunction may not be unusual. Both types were worked at the Calenick smelter, near Truro, which operated between 1702 and 1891, as well as at Treyew and Carvedras, all in Cornwall. (Tylecote 1980, 4) The use of both types would allow the widest range of ore quality to be smelted. Cook, Greeves and Kilvington cite stannary documents, which indicate the production at Eylesbarrow of "grain tin", which was the highest quality of tin metal, usually smelted in a blast furnace, and of "common" or "refined" tin, which were usually smelted in a reverbatory furnace. (1974, 194) Cook, Greeves and Kilvington point out that it is unlikely that enough stream tin was extracted in the 1820's to produce 692 blocks of grain tin in less than ten years, but they suggest that high grade lode ore from Eylesbarrow may have been suitable for the blast furnace. (*op. cit.*, 196) The presence of high grade ore may be supported by the claim in Mining Journal that "the tin raised in this sett is of a superior quality ... being best grain tin, the market value of which is full £15 per ton more than that of common tin" (MJ 10.4.1847) Field evidence survives for both furnaces.

i) The Blast Furnace

The Eylesbarrow blast furnace consists of two columns of massive granite blocks. (see Plate 5:20) One column stands upright, 1.50m high, set into the back wall of the dressing floor. The other is now fallen, but originally would have stood 1.52m away, facing the first column, on an alignment parallel with the wheel-pit. It is assumed that blast furnaces originally had a clay or refractory brick lining, which was replaced, probably frequently, when damaged or coated with slag accretions. (Earl 1986, 21) It is possible that the stepped moulding near the top of what would have been the inner face of the fallen column was provided to support a removeable lining. (see Plate 5:21) The original shape of the furnace is not clear from extant remains, but comparison with other furnaces and documentary evidence may assist reconstruction.

Earl points out a distinction between shaft furnaces, in which the bellows nozzle is inserted on the same side at which tin is extracted, and furnaces with the nozzle on the opposite side from the float or tap hole. (1986, 18) He suggests that the former is earlier; it would be appropriate in the typical Medieval Dartmoor furnace, described by Worth as "areas surrounded by walls on three sides and open to the house on the fourth". (Worth 1940c, 232) In these, a lining or "lute", probably of china clay and charcoal would have been constructed within this framework, and the open front around the nozzle and tap hole could be blocked with a slate, thin granite slab or an iron plate. (Earl 1986, 19) The use of such a design is also supported by documentary evidence. In Beare's description of a Cornish furnace in 1586, the reference to the critical distance between the "hearth eye" (ie the nozzle hole) and the "tynhole" (ie tap hole) suggests that both are on the same side. (quoted in Greeves 1981, 237) Tin ore was successfully smelted by Earl in a furnace of this kind. (1986, 18-27)

Plate 5:20 The blast furnace, **Mon 1066c**

Plate 5:21
Close-up of the moulding on the blast furnace

The other type may be a later development. In Pryce's description of a shaft furnace or "castle", his observation that the bellows, as well as urging the fire, were able to force molten tin through a hole in the bottom of the furnace suggests that the bellows were on the opposite side of the shaft from the tap hole. (Pryce 1778, 136-7) (See Fig. 5:38) These two sides would have been temporarily blocked like the single "open" side on the Medieval furnace. Therefore the archaeological remains of a "castle" may comprise two opposing columns of permanent masonry, similar to those at Eylesbarrow.

While Pryce's account and the Eylesbarrow furnace are clearly late 18th/19th century structures, the chronological distinction between three-sided and two-sided furnaces may not be clear-cut. Worth's argument that the Medieval furnace was three-sided is based on his survey of extant remains on Dartmoor. However, this includes as furnaces, the recesses which , as noted above, Greeves disputes. The only obvious furnaces accepted by Greeves are Merrivale (lower left bank of the R Walkham above Merrivale Bridge), Avon Dam and probably Outer Down, in the S Teign valley. (1981, 234, 239) Merrivale, at least, seems to fit the three-sided pattern, but the Avon Dam furnace consists of two free standing blocks, while the furnace at Outer Down may have been contained within the gap in a "cross-wall". (Greeves 1981, 234; Worth 1927, 344; Tylecote 1986, 47) Thus in the latter furnaces, the tap hole may have been on the opposite side to the bellows so that the Eylesbarrow design may have earlier precedents. It is worth noting that a blast furnace for iron smelting below Hepstock and Awsewell Rocks, on R Dart, consisting of two "permanent abutments" for a perishable furnace was in use in 1605. (Worth 1940c, 236)

The 1.52m wide gap between the two columns in the Eylesbarrow blast furnace is much bigger than the equivalent gaps at Avon Dam, Outer Down and Merrivale, which all fall within the range 0.51m - 0.66m. (Greeves 1981, 234, 239) A thicker lining or "lute" may have been a late 18th/19th century development and accords with Tylecote's reconstruction of Pryce's "castle". (See Fig. 5:38a) This might reflect the use of a different refractory material, such as fire bricks instead of clay, or the furnace may have been bigger. Pryce's furnace measured 1.83m (6ft) high and 0.61m (2ft) square or in diameter at the top tapering to 0.36m

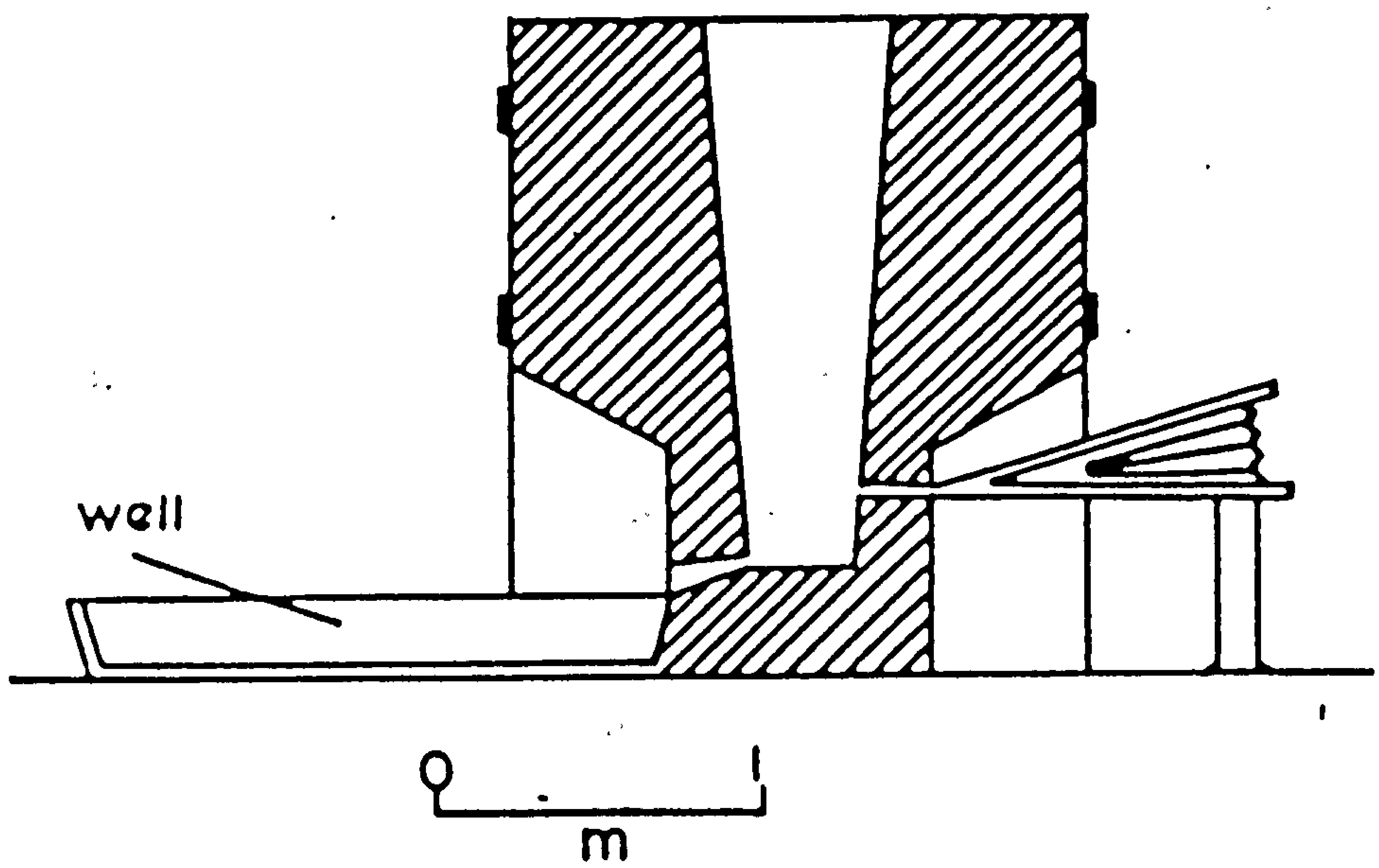


Fig.5:38a Pryce's "castle" or blast furnace
(from Tylecote 1986 fig 18)

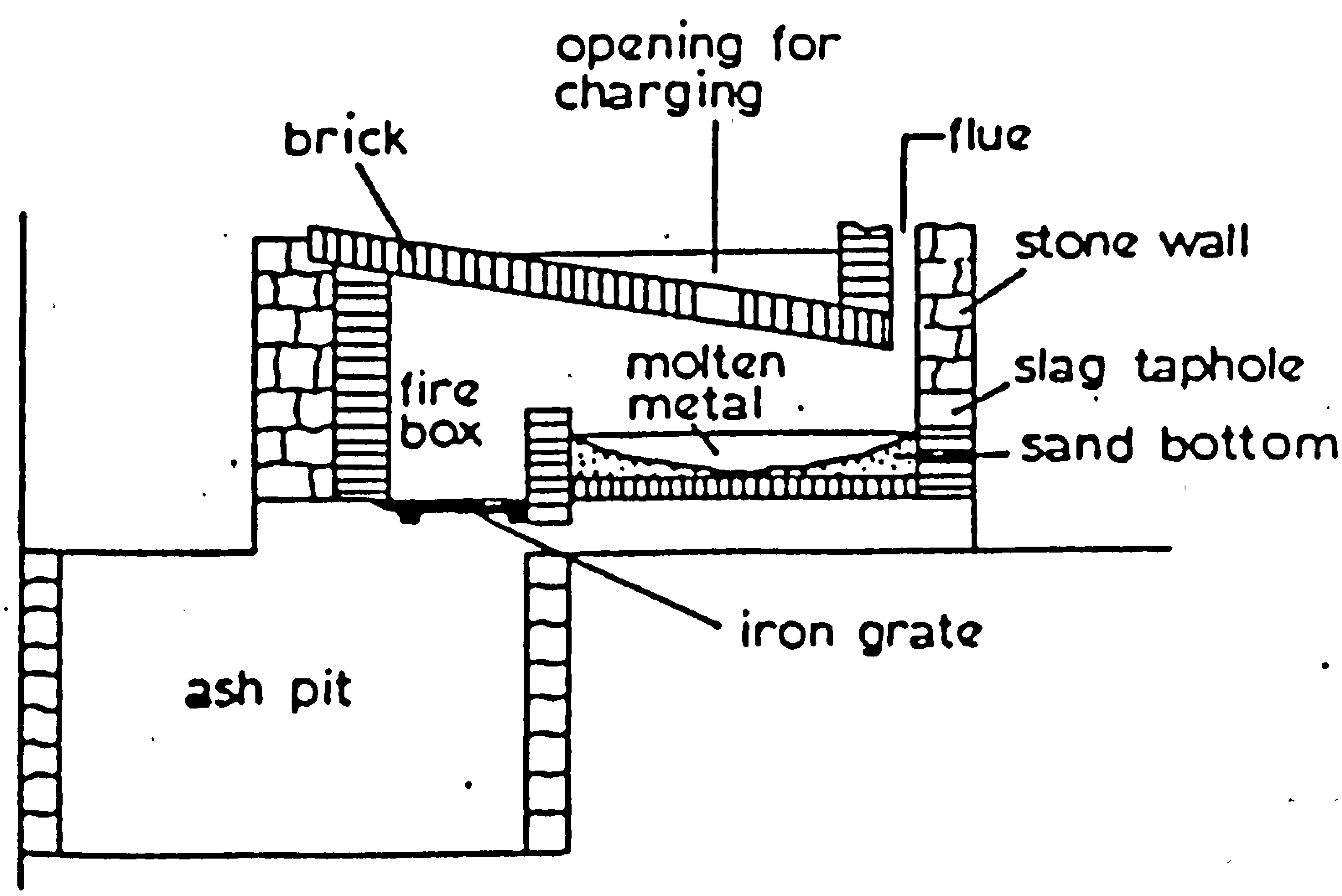


Fig 5:38b the reverbatory furnace
(from Tylecote 1980, 10)

(14ins) across at the bottom. (Pryce 1778, 136) The fabrication of a lute, 0.45m thick at the top and 0.58m thick at the bottom would accomodate a furnace of similar internal dimensions to Pryce's. However, the Eylesbarrow "castle" was certainly shorter than Pryce's and therefore may have been proportionately narrower; Greeves suggested that Devon furnaces may have been consistently smaller than their Cornish counterparts. (See below p.528 ; Greeves 1981, 252) Tylecote's reconstruction of Pryce's "castle" suggests that the thickness of the lute at the top is equal to the width/diameter of the top of the furnace. (1986, 45, Fig.18) Therefore, the Eylesbarrow furnace could have measured 0.51m across the top. Pryce's "massive stones" were "cramped together with Iron to endure the united force of fire and air", but there was no sign of iron staining on the Eylesbarrow columns. (Pryce 1778, 136)

<u>Procedure</u>

The smelting procedure described by Pryce may be similar to the practice adopted at Eylesbarrow. Black tin and charcoal were laid in the "castle" "stratum super stratum". (Pryce,1778,136) Pryce recommended 8-12cwt of black tin (400-600kg) and 18-24 sixty gallon packs (about 1200-1500kg) of charcoal. (*ibid.*; Tylecote,1986,44) The quantities may have been less in the smaller Eylesbarrow furnace, and Hatchett noted that only 2cwt was smelted at one time in the St Austell blast furnace, but the same ratio of 2.5-2.8:1 for fuel:ore may have been adopted. (Raistrick 1967, 27) Peat charcoal was normally used in Dartmoor instead of the standard wood charcoal in Cornwall. However, Earl suggests that the same proportion of peat charcoal would suffice, though it may have caused more impurities, notably iron and calcium. (1986, 27) In 1847, and presumably also in the 1820's when the smelter was in operation, Eylesbarrow Mine was allowed unlimited supplies of peat from the Moor "at no charge whatever". (<u>MJ</u> 5.6.1847)

In 1586, Beare advised that ore should be placed in the furnace in order, according to quality, starting with different grades of stream tin, followed by lode tin. (quoted in Greeves 1981, 250) This may not have been relevant at Eylesbarrow, where the low grade tin went to the reverbatory furnace. A single smelting operation lasted a period of twelve hours, known as a "tide". (Pryce 1778, 136) Earl's experimental work substantiated Agricola's claim that the furnace required re-lining after each smelting. (Earl 1986, 21; Agricola 1950 ed., 416) Earl suggests that the capacity of the float and ultimately the mould probably corresponds to the amount of tin, which can be smelted in a particular furnace in one tide. (1986, 28) Thus Greeves suggests that the smaller ingots found in Devon (eg at the beginning of the 17th century, 200lbs. compared to 300-400lbs. in Cornwall) may be products of smaller furnaces. (1981, 252)

Unfortunately, there are no remains of the float or moulds *in situ*, though it is possible that the broken mould on top of a wall at Ditsworthy Warren House, originated at Eylesbarrow. (see above p.477; Plate 5:6) However, records of output at Eylesbarrow indicate that blocks of tin produced between 1822 and 1831 were about 3cwt each. (Cook *et al* 1974, 198, App.B)

Bellows

Earl found that bellows positioned at the front of the furnace severely limited available working space. (1986, 28) It is possible that this encouraged the transfer of bellows to the back of the furnace. Pryce recommended the use of two bellows, each 2.44m (8ft) long and 0.76m (2½ft) wide at the broadest part. (1778, 136) They were presumably manufactured from wood and leather; Agricola recommended ox-hide. (1950 ed., 364) The nozzle was inserted 0.25m (10ins) above the bottom of the "castle", into a wrought iron component, called a "hearth-eye". (Pryce 1778, 136)

The simplest method of operating water-powered bellows may have been by a cam-shaft, similar to those used on Eylesbarrow stamping mills. The upper board of the bellows would be fixed, so that cams, rotating on a shaft, pushed up the lower board and then let it fall. (Biringuccio 1942 ed., 301-2) Alternatively, the lower board was fixed and a rotating crank shaft, caused a pivoted cross-bar to press down the upper board of each bellows alternately. (*ibid.*)

The position of the Eylesbarrow furnace with a front-to-back axis at right angles to the wheel pit, might suggest that the bellows were arranged perpendicular to the wheel. The 2.70m wide gap between the wheel-pit and furnace might just accomodate 2.44m long bellows with a gearing system to change direction of power. However, the bellows could still have been arranged parallel to the wheel, with a system of pipes to transmit draught to the furnace. These variations were necessary because the furnace was built against the back wall of the smelting house, probably to link up with the flue. Therefore even if the front-to-back axis was parallel with the wheel, there is no space behind the furnace to accomodate bellows.

The Flue

Early blowers were concerned that tin could be blown away in dust, a problem also encountered in experimental smelting by Earl. (1986, 22) Carew noted the practice of setting fire to the thatch roof of the smelting house every seven or eight years in order to capture escaped tin particles. (1811 ed., 42) An alternative Cornish solution was to "frame the tunnels of the chimneys very large and slope therein to harbour these sparkles". (*ibid.*) Earl noted that the split-level arrangement of some Medieval Dartmoor blowing houses may have been to accomodate a dust-collecting chamber above the furnace., akin to those described by Agricola in 16th century Germany. (Earl 1986, 28; Agricola 1950 ed., 394) "Chambers" have been recorded on Dartmoor tin mills, such as Deep Swincombe and Glazemeet, but neither site has other evidence of smelting. (Greeves 1981, 247)

These devices were developed by the 18th and 19th centuries into a flue. In 1796, at the blast furnace at St Austell, Hatchett observed a 20 fathom-long, inclined chimney, "which terminates ... in a circular building, which receives the Tin accidentally raised by the heat." (Raistrick 1967, 26) At Eylesbarrow, a tunnel, extends horizontally for 18m, with a change of direction after 2m. A hole 0.50m from the bend may have allowed access to collect tin. (see Plate 5:22) The stack at the end, now completely collapsed, may have been sufficiently preserved in the late 19th century and early 20th centuries to be recorded by Burnard (1888/9, 235) and Worth (1940c, 222-3). "A tall chimney" was still visible to a tourist in 1864. (Butler ed. 1986, 7) The flue presently begins, 5m away from the furnace and there is no indication how they were originally connected. The flue consists of dry stone walls roofed with granite slabs. Cook, Greeves and Kilvington record a paved floor, 0.25m (10ins) below present ground level and also suggest that the flue may have been sealed by a layer of small stones, soil and turf. (1974, 197)

Plate 5:22 The flue, **Mon 1066f**

<u>Efficiency</u>

Finally, the efficiency of the blast furnace can be considered. Yield undoubtedly varied according to the purity of the black tin concentrate. In 1602, Carew calculated that 2lbs of high quality black tin would yield 1lb white tin (1811 ed., 50), though techniques may have improved slightly by 1733, when 20lbs of black tin could produce 11-13lbs of white tin. (Tonkin 1811 ed., 50) Efficiency could undoubtedly be increased by re-working the slags. Slag containing unreduced cassiterite could be returned to the furnace, and prills of tin metal could be recovered by stamping slag. (Earl 1986, 26). Cook, Greeves and Kilvington suggest that the stamps at the Eylesbarrow smelter may have been devoted to slag treatment. (1974, 188) The lute itself may have been stamped. It is possible that examination of waste heaps near the site may reveal, as well as slag, fragments of lute, such as those uncovered at Week Ford. (Earl,1986,19)

It is interesting to note that, in an analysis of slags from eight Dartmoor blowing sites, Eylesbarrow had one of the highest figures (17.3%) for tin oxide content in slag. By comparison, the Medieval furnaces at Outer Down, Thornworthy and Stannon Brook had less than 10% oxide. (Greeves 1981, 260) It is possible that this reflects the use of lode ore at Eylesbarrow and, therefore, reduced purity of concentrate.

ii) Reverbatory Furnace

Worth deduced that unusual slag at Eylesbarrow was from a reverbatory furnace, "in consequence of the use of lime as a flux; and although the mass is still glassy, it contains many crystallites." (1940c, 223)

The large granite blocks at the E end of the smelting house are the remnants of the reverbatory furnace, though their original configuration is unclear. Burnard's photo of 1889 shows a low construction in this position, which seems to extend across the building. (Greeves 1986, 3) This basic shape is consistent with the reverbatory furnace illustrated by Pryce. (1778, Plate 6) (See Fig. 5:38b) According to Pryce, reverbatory furnaces for tin smelting were similar to, but "not so deep" as copper furnaces, which were 18ft (5.49m) long by 13ft (3.97m) wide internally and 9½ft (2.90m) high. (1778, 282, 272) The reverbatory furnaces at Calenick tin smelter near Truro were said, in 1796, to be 6ft (1.83m) high, with hearths, 7ft (2.14m) long, 3½ft (1.07m) wide and 9 inches (0.23m) deep. (Raistrick 1967, 29) Pryce's illustration shows a stone masonry exterior with a fire-brick lining. (1778, Plate 6) The large granite blocks at Eylesbarrow were obviously the outer framework, as in the blast furnace, and the broken slagged fire-bricks found by Cook, Greeves and Kilvington were presumably part of the lining. (1974,195)

The main difference between the blast furnace and the reverbatory furnace is that, in the latter, the fuel is burnt in a firebox, separated by a partition from the hearth containing the ore charge. Heat from the fire is reflected onto the hearth by a sloping roof. Thus a long flame fuel, ie coal rather than charcoal, is necessary for the heat to reach the roof. (Tylecote 1987, xxiii) A chimney was built at the far end of the hearth and a pit, dug below the firebox, collected ash. There is no trace of either of these at Eylesbarrow. though excavation may detect the latter and thereby indicate the original positions of firebox and hearth.

Pryce recommended that one charge would consist of 5-6cwt of tin, "well mixed with a tenth or a twelfth its weight of culm." (1778, 282) The latter was required as a reducing agent and could have been imported from Bovey Tracey, which was supplying Calenick in the 1730's. (Tylecote 1980, 3) Additional substances could be introduced as a flux: Worth thought that lime had been used at Eylesbarrow, while from an analysis of slags, Tylecote suggested that iron ore had been used at Calenick. (Worth 1940c, 223; Tylecote 1980, 7) Welsh coal was the standard fuel but the amount required is not specified; the fire had to be well ablaze for six hours. (Pryce 1778, 282-3) In 1847, it was considered that coal could easily be brought to Eylesbarrow by the Dartmoor Railway from Plymouth. (MJ 5.6.1847) As the railway opened in 1823, this route would have been available when the smelting house was operating. (Harris 1968, 170)

According to Pryce, the ore charge was shovelled into the hearth and raked level, after which the furnace was sealed and the fire stoked up. (1778, 283) After four or five hours, the contents could be checked and more culm added, if necessary. After a total of six hours, tin metal was tapped out onto a float. (*ibid.*) Tylecote suggests that a charge of 250kg to 300kg of ore might be reduced to 175kg to 200kg of tin metal in the first smelting. (1980, 6) This impure metal would be refined in a cooler reverbatory furnace or in a refining kettle. (Tylecote 1980, 6) At Eylesbarrow, the finished metal ("common" or "refined" tin) was cast into blocks of the same weight (about 3cwt) as the blast furnace "grain" tin. (Cook *et al* 1974, App.B)

5.9 ANCILLARY BUILDINGS

Non-industrial structures associated with tinworks may be divided, like the processing sites, into two groups. One distinct group consists of the structures associated with Eylesbarrow Mine and, therefore, dates to between 1816 and 1852. The remaining structures, mostly situated on valley floors, are of unknown date but are presumably contemporary with their associated tinworks and, therefore, date, perhaps, no later than the 17th century.

5.9.1 Early ancillary buildings

The function of the Eylesbarrow structures can be identified from contemporary documentation but the other sites can only be interpreted as "shelters" or "stores". Some form of structure would presumably have been useful for the storage of equipment and, more importantly, black tin. A 17th century comment, on Cornish practice, that black tin was "put up into Hogsheads covered, and lockt till the next blowing" suggests, as Gerrard points out, that secure storage was required. (quoted in Gerrard 1986, 166) The provision of a secure store would have been just as necessary in the Plym valley. Greeves cites examples of lawlessness among the tinworking population, including a reference to the theft in 1519 of 30 gallons of black tin, worth 20 marks from Stertmore tinworks in the neighbouring Cornwood parish; the goods were handed over at Cadworthy [Cadover] bridge, just outside UPV. (1981, 113-4)

Contemporary accounts also attest the provision of shelters, such as "little howses buylte for the stannarie men to shrowd them in neere the workes" or "a little lodge made up with turves covered with straw." (Gerrard 1986, 163) Some of the UPV structures may also have had such a function, though whether they were residential or simply for occasional use cannot be determined from surface indications and little further information on function has been revealed by excavations, such as East Colliford and Redhill Marsh, Bodmin Moor. (Gerrard 1986, App II & III)

The group of early structures comprises **Mon** 206 on Legis Lake, **Mons** 221, 1081 and 1181 on the R Plym, **Mons** 1082 a-d and **Mons** 1173b, d and possibly c and f on Langcombe Brook, **Mon** 1184 on Crane Lake, **Mons** 589h and 820 amidst prehistoric enclosures on the S bank of the R Plym and **Mon** 709 on northern Ringmoor Down. A "beehive hut" was recorded in Evil Combe by Crossing (1912, 433) and Hemery (1983, 194) but, unfortunately, was not located between 1982 and 1986.

These structures all consist of a single rectangular compartment and vary in size from 2m x 1.35m (**Mon** 1082b) and 2.5m x 2m (**Mon** 1184) to 7m x 4m (**Mon** 589h) and 7m x 3.25m (**Mon** 820). The remainder are mostly between 3m and 4m long and from 1.8m to 3m wide. Surveys of post-prehistoric structures on Central North Dartmoor, mostly associated with tinworks, by Le Messurier (1979) and of structures associated with tinworks on Bodmin Moor by Gerrard (1986, 283-290) provide useful comparisons. Gerrard divided the Bodmin corpus into two size-groups, suggesting that a structure less than 2.5m in length could not have been anything but a store, while those above 2.5m could have served as stores and/or shelters. Following this distinction, only **Mon 1082b** and probably **Mon 1184** in UPV could be defined as stores.

The UPV structures are all closely-associated with streamworks apart from **Mon 709**, which is adjacent to lodeworks on Ringmoor Down. Three, **Mons 1082c, 1082d** and **1184**, are cut into streamwork waste heaps, and a further three, **Mons 221, 1081** and **1181**, are cut into the escarpment, which marks the limit of streamworking. This practice was also observed by Gerrard on Bodmin Moor at the excavated site at East Colliford and also at High Moor, Leskernick and Redhill. (1986, 284-5) Gerrard suggests (1986, 288) that "the subterranean character" of the East Colliford structure indicated its function as a well-concealed store for equipment and black tin. A similar effect may have been achieved by the builders of Le Messurier's Type A structures, which had been "banked up" externally, so that entering one "must have been like going underground". (1979, 62) The structure, **Mon 221**, below the western prehistoric enclosure at Legis Tor, measuring 3.10m x 1.80m, is perhaps the closest parallel to East Colliford and may well have acted as a safe. However, its greater size and presence of a recess, possibly a fireplace, in the N end suggest that it may also have served as a shelter. **Mons 1082d** and **Mon 1181** are even larger (6m x 3m and 5m x 3m respectively), and these may also have combined the functions of storage and shelter.

The three remaining "subterranean" structures, **Mons 1081, 1082c** and **1184**, have only three sides and, although the fourth side could have been covered with wood or turf, the structure would still be rather less well-concealed. These and another two three-sided structures, **Mons 1173b** and **d**, may have served simply as shelters. Ten such structures were found on Bodmin Moor by Gerrard, who compared them with "the small open-ended galvanized shelters used by present-day contractors." (1986, 283-6) The "three-sided hut", recorded by Le Messurier on the West Okement river (site 49) may be another example. (1979, 71)

Two other structures, **Mons 1082a** and **b**, in Lower Langcombe Brook are rather crudely-constructed, consisting simply of rubble walls, abutting one or two groundfast boulders. These correspond to Le Messurier's Type C structures, five of which were identified on Central North Dartmoor and interpreted as shelters, which gave "protection to stores, or perhaps to people for an hour or two during inclement weather". (Le Messurier 1979, 62) The UPV examples were situated close to two other structures, one three-sided (**Mon 1082c**) and one of a larger size (**Mon 1082d**) and it is possible that the types of construction reflect different functions. This group of closely-spaced structures and the group of possibly four rectangular structures, **Mons 1173b, c, d** and **f**, in Upper Langcombe Brook, may be unusual. Ancillary structures on Bodmin Moor usually occur singly (Gerrard 1986, 283) and only one instance of two adjacent structures was recorded on Central North Dartmoor. (Le Messurier 1979, 69)

Finally, some ancillary buildings clearly made use of existing prehistoric structures. Some hut-circles (eg. **Mons 819c** and probably **1173e**) were robbed in the construction of tinners' buildings (**Mons 820** and **1173b** and **d** respectively), while others were simply modified for re-use, such as **Mon 206** and possibly **Mons 589h** and **1173c** and **f**. Many more hut-circles may have been re-used with little modification. No evidence of any occupation by tinners was found in the excavated hut-circles at Legis Tor. (Baring Gould *et al* 1896, 183-9) However, tin ore and slag, Post-Medieval earthenware and a Henry VII coin found above the Bronze Age occupation floor at hut-circles at Metherel, demonstrate re-use elsewhere. (Worth 1935, 124-7; 1937, 145-7)

Thus it may be concluded that a number of structures associated with early tinworks, have been constructed by a variety of methods, all of which are paralleled elsewhere on Dartmoor and on Bodmin Moor. The method of construction may correspond to a particular function, but it is probably more likely that structures occuring singly combined the functions of storage and shelter. Some of the larger structures could have provided accomodation rather than simply shelter, though there is no evidence to substantiate this.

5.9.2 19th century ancillary structures

With the aid of contemporary documentation, particularly the 1823-31 and post-1836 plans, nearly all the ancillary structures at Eylesbarrow can be identified. (WDRO WW21; WW20a) These were not restricted to storage or shelter; thus **Mon 1143** was the blacksmith's shop, **Mons 1129** and 1130 were the turf and timber houses respectively and **Mons 1128** and **1137** were powder houses. **Mon 1136**, known as the sample house, may have been for assaying and the small rectangular structure, **Mon 1098b**, was presumably associated with the adjacent engine wheel-house, **Mon 1097** and may have been used for storage. Remaining buildings at Eylesbarrow were residential. The barrack house, **Mon 1135**, presumably provided accomodation for the miners, though after 1836, it was described as the dwelling house and may only have housed Capt. Gregory and his family. The account house, **Mon 1134**, was refurbished in the 1840's, probably by JH Deacon and described as a mansion house in 1847. (MJ 10.4.1847) It continued to be used as a dwelling after mining ceased. (see above p.230) Another official may have inhabited the two-compartment house, **Mon 1069**, with its own enclosure, to the N of the stamping mill/smelter, **Mon 1066**.

The barrack and sample houses and one powder house, **Mon 1137**, have been levelled to their foundations and the timber house is mostly marked by a heap of rubble. Surviving structures reveal construction of mortared masonry and the account house, built of large squared blocks, is particularly imposing. Two other structures, **Mons 1193b** and **1188**, at Crane Lake were probably associated with the 19th century Wheal Katherine.

5.10 LEATS IN THE UPV

Leats form a significant part of the archaeological record of Dartmoor, not least in UPV. They were dug to provide a water supply for domestic purposes or to drive machinery in mills or mines. Most leats in UPV were for mining, though two leats supplied domestic "pot-water". (**Mons 727a** and **98/ 121/135/137/141**) (See Table 5:8)

Table 5:8 Leats in the Upper Plym Valley.

Mon No.	Sheet No.	Title	Max. Traced Length	Original Total Length	Source	Destination	First known Date	REMARKS
TIN MINES-PUMPING AND STAMPING								
47	2,7,8 15,16	Bottle Hill Mine / Lee Moor China Clay Leat	4393m to Big Pond	?	R.Plym above Hentor Brook	Originally Bottle Hill Mine, now Big Pond.	1825	An "Old Leat" was cleared in 1825 to make this leat ; caused a dispute with Trowelesworthy Warren.(WDRO72/949;710/224,225) When mine closed in 1877, leat taken over by Lee Moor China clay works, Still Working.
436	8,16	-	1500m	?	R.Plym above Hentor Brook	?	pre-1825	May be an unused part of the "old leat", cleared in 1825 to supply Bottle Hill Mine, Mon 47.
208	7,8.	Yeoland Consols Leat	890m	≈5-6km.	R.Plym near confluence/ Spanish Lake	Yeoland Consols Mine	Late 19th. Cent.	Supplied Yeoland Consols Mine on R.Meavy near Clearbrook. Constructed within memory of R.H.Worth(Spooner & Russell 1967,146)
220	7.	-	500m	≈710m to Legislake	R.Plym	Legis Lake ?	?	Possibly former course of Yeoland Consols Leat. S. of Mon.208. Or for Streamworks in Legis Lake.
1075	19,25 26,27 30,31 32	Engine Leat	4520m	4520m to Reservoir	Langcombe Brook	Eylesbarrow Mine reservoir Mon.1100	1816	Constructed before 1831, possibly in 1816, to supply engine-wheel house, Mon.1097, and series of stamping mills at Eylesbarrow Mine. Out of use by 1847. (WDRO WW21,WW20a);Dickinson,1975,103)
1052	25,26 27,30 32.	Stamping Mill Leat	2 km.	2 km.	R.Plym at Evil Combe	Tailrace of Engine Leat Mon.1075	1823-1831	Augments water supply in tail race from Engine Leat, Mon.1075. Feeds stamping mills Mons.1070,1066, and 1064. (WDRO WW 21,WW20.)
1005	25,26	-	485m	≈625m	R.Plym	Colesmills Tin Mill	?	Supplied water for Colesmills/Mill Corner stamping mill. Mon.1004.
1194	32	-	350m	350m	R.Plym	? Stamping Mill. Mon. 1185	?1823 - 1831	Headweir is upstream of headweir for Engine leat,Mon.1075. Probably used to supply stamping mill, Mon.1185, 22m to SW. via wooden launder. Possibly originally used for streamworks in Crane lake.

Table 5:8 (Continued)

Mon No.	Sheet No.	Title	Max. Traced Length	Original Total Length	Source	Destination	First known Date	REMARKS
DOMESTIC								
727a	24, 16.	Ditsworthy Pot Water Leat	800m	800m	Longstone Leat	Ditsworthy Warren House	?	Outflow from Longstone Leat, Mon,717,brought water to Ditsworthy Warren House. Still Working in 1940's.
727b	24, 25	Ditsworthy Leat	610m	650m to Mon727a	Drizzle Combe	Mon727a then Ditsworthy.	?	Disused leat which formerly bought water to Mon 727a, for Ditsworthy.
746	24, 25.	Ditsworthy Leat	230m	230m	Drizzle Combe	Mon727a then Ditsworthy.	?	? Former course of E part of Mon 727b.
742	24, 25.	Ditsworthy Leat	510m	510m to	Drizzle Combe	Mon727a then Ditsworthy	?	? Former course of Mon 727b.
98a	7,8.	Trowlesworthy Pot Water Leat	535m	710m	Spanish Lake	Mon 98b then Trowles-worthy Warren House	pre-1825	Originally provided water supply to Trowlesworthy Warren House, via leats. Mons 98b,121,135,137,and 141. Damaged (?and abandoned) by construction of leat, Mon 47. Continues S of Mon 98b, possibly as emergency run off.(WDRO 72/949)
98b/121/135/137/141	7	Trowlesworthy Pot Water Leat	525m	525m	Mon,98a (Ultimately Spanish Lake)	Trowles-worthy Warren House	Pre-1825	Fragments of leats, which may originally have formed Trowlesworthy Pot water leat. Mon 98b may have been truncated at W,end by Mon,47, during controversial work in 1825. (WDRO 72/949) Water collected in reservoir,Mon,136. Leat Mon,141 issued into outhouse,Mon 130g, which housed a water wheel and generator.(Haynes Map Tro 11)
MISCELLANEOUS								
725	29	-	130m	?	?	?	?	Direction of flow cannot be ascertained.
802	24	-	580m	?	?	?	?	Upslope from Longstone Leat, Mon,717. ? Possibly an early course of Longstone Leat.
1180	32	-	47m	?	?	?	?	?

Table 5:8 (Continued)

Mon No.	Sheet No.	Title	Max. Traced Length	Original Total Length	Source	Destination	First known Date	REMARKS
303a 710, &699	22,	-	1520m	?	Sheepstor Brook	Shafts on Ringmoor Down	?	Mons, 303a, 710 and 699 may be the surviving fragments of a single leat, ? Part of Kit Mine,
303b	22	-	190m	-	-	-	?	May be earlier course of W. end of Mon.303a.
711	23	-	230m	-	-	-	?	May be earlier course of E. end of Mon 303a.
667/703	23	-	740m	950m Includes Mon.692	?Surface run off	Gutter Mire	?	Probably supplied streamworks in Gutter Mire, may have joined ditch, Mon,692, after gap of 140 m,
685 a-c	23	-	160m	?	?surface run off	Gutter Mire	?	3 fragments of a single leat, Probably supplied streamworks in Gutter Mire.
693 a-d	23	-	160m	?	?surface run off	Gutter Mire	?	4 fragments of a single leat, Probably supplied streamworks in Gutter Mire.
1010	23	-	345m	≈ 700m	R,Plym	Lower Drizzle Combe	?	Downslope from Mon,1013, Carried across gully,Mon 1018 by retaining bank, May pre-date streamworks on R,Plym which has truncated NE end.
1013	25	-	350m	≈ 790m	R,Plym	Middle Drizzle Combe	?	Upslope from Mon,1010, Carried across gully, Mon 1018 by retaining bank, May pre-date streamworks on R, Plym, which has truncated NE. end.
1051	25	-	410m	1510m from R. Plym	R,Plym?	Middle Drizzle Combe.	?	Possibly originally connected to, and fed by leats Mons, 1052 or 1053, Or collected surface run-off,
1053	25,26 27,	-	1050m	1710m to Upper Drizzle Combe or 1510m to Lower D-C	R, Plym below Evil Combe	Upper or lower Drizzle Combe ?	?	Possibly originally continued to Upper Drizzle Combe, but N,part used by Stamping Mill Leat,Mon,1052, Or may have joined Mon 1051 and supplied middle Drizzle Combe, Outflow may have supplied Stamping Mill, Mon 1089,
1182	32	-	30m	?	Crane Lake?	R.Plym ?	?	Curves round shaft, Mon 1183, ? Post Dates Shaft.
1195	32	-	35m	?185m from R.Plym	? R, Plym	Crane Lake	?	Fragment of ? Leat may have originated at R,Plym, May have joined Mon. 1196, which may be retaining bank.

Table 5:8 (Continued)

Mon No.	Sheet No.	Title	Max. Traced Length	Original Total Length	Source	Destination	First known Date	REMARKS
CHINA CLAY WORKS.								
520	10,9, 17,25 26.	Phillips Leat	4735m within UPV	6335m to Big Pond	R.Plym above Langcombe Brook	Big Pond and then Lee Moor China Clay Works.	≈1835	Flows down Spring Tide to Big Pond. Dug between 1833 and 1838. (Haynes 1976,259-60) When Bottle Hill Mine closed in 1877, Mon 47 was available and Phillips Leat abandoned ≈ 1879. In August 1972 earthwork dam built across leat to dam water from Cotor Brook into Spanish Lake (Haynes Map VIL 24 TRO 50). By 1986 a deep gulley had been dug from Cotor Brook directly to Spanish Lake, and bypasses reservoir.(Hemery 1983,197,199,208).
470	2,3.	Lee Moor China Clay Storm Leat	1000m	1000m	-	China Clay Works	1977	Dug by English China Clay Ltd. to collect surface water from steep slopes to the N. in the event of flash flooding.
MILLS								
717	23,29 24,25	Longstone Leat	2040m within UPV	≈4½-5 km to Longstone Manor	Drizzle Combe	Longstone Manor	1623	Originally for Mills on Longstone Manor. In 1623 Walter Elford of Sheepstor agreed to divert the tailrace from Longstone Mill leat from "Thrushel Combe" Brook into R. Meavy above Headweir of Plymouth Leat. (Hawkings 1987, 35).Still working but now disgorges into St.Leonards Well. (Hemery 1983,117).
1028	25, 26.	Longstone Leat	1030m	1380m to Drizzle Combe	R.Plym	DrizzleCombe and then Longstone Manor	?	Originally part of Longstone Leat, but now disused. Still working in 1823-31 - marked and labelled on Plan of Ellisborough Tin Mine (WDRO VW21)

The water supply leats for Plymouth and Devonport are perhaps the most impressive engineering feats. The Plymouth leat, completed in 1591, brought water to the town from Headweir on the R. Meavy (now under Burrator Reservoir) 17 miles away, while the Devonport leat, built 1793 - 1797, covered a distance of 40 miles. (Hawkings 1987, 8, 51-2) However, some mining leats also covered considerable distances. A total of 14½ miles of leats were dug by 1835 to supply different water-powered machinery at Owlacombe Mine, Ashburton parish. (Dickinson 1975, 102) The Reddaford Leat, constructed some time before 1824, brought water over 10 miles from Tavy Cleave to Wheal Friendship copper mine at Mary Tavy. (Harris 1968, 213)

It might be assumed that such a system would be heavily dependent on the amount of rainfall; drought could stop work altogether. Certainly an insufficient water supply for pumping and stamping hampered many Devon mines in the 19th century and probably encouraged the early adoption of steam engines in Cornish mines. For example in the 1850's, Wheal Emma, W of Buckfastleigh was continually short of water even after a 10-mile leat was dug from the R. Swincombe to the R. Mardle. (Barton 1968, 187)

However, leats rising on the high moor, such as the UPV leats, had two advantages over those situated beyond the granite mass. A comparison of monthly figures from 1916 to 1950 indicates that locations on the high moor, such as Princetown, experienced a considerably heavier rainfall than "in-country" towns, such as Newton Abbot or even towns on the edge of the granite mass, such as Okehampton. (Douglas 1963, 93) (See Table 5:9) In UPV, where the watershed is at an elevation up to 470m, the figures for Princetown are probably the most accurate. Measuring the surface area above, for example, Phillips Leat, **Mon 520**, the maximum amount of water available at the headweir of this particular leat can be calculated, though some water would also have been captured downstream from Langcombe, Shavercombe and Hentor Brooks. (See Table 5:9)

Furthermore, the source of the moorland streams and leats, which can be viewed as an "enormous sponge of wet peat" regulates the supply of water. (Radford 1889, 206) Drought may have been less of a problem where, as Radford found by experiment, five gallons of water are

Table 5:9 Average rainfall 1916 - 1950.

Location	Height(m)	Rainfall (mm per year) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
NEWTON ABBOT	82.96	119	81	73	64	64	49	66	75	75	97	121	116	1000
OKEHAMPTON	213.50c	168	114	92	91	78	67	98	104	105	146	165	161	1390
PLYMOUTH	35.99	109	78	69	56	60	51	65	73	73	97	113	114	959
PRINCETOWN	414.50	275	173	150	132	124	115	167	170	169	230	260	261	2226
SHEEPSTOR	231.80	187	125	106	90	91	82	119	122	124	165	189	188	1590
Max. Vol of water caught by Phillips Leat Mon 520	Million Litres	847.85	533.38	462.46	406.97	382.30	354.55	514.88	524.13	521.04	709.11	801.61	804.69	6863.00
	Million Gallons	186.52	117.34	101.74	89.53	84.11	78.00	113.27	115.30	114.63	156.00	176.35	177.03	1509.80

NOTES
1)Maximum volume of water available to Phillips Leat is calculated as the rain falling on watershed of R.Plym above the headweir of Phillips Leat(calculated area=3,083,125 m^2.).
2)Calculation ignores presence of other leats.
3)Calculation uses rainfall figures for Princetown.

(After Douglas, 1963,93 Table III)

contained in a cubic foot of saturated dense peat. (*ibid.*) Thus an acre of peat 5ft deep could hold over one million gallons. (*ibid.*) "It is well known on the borders of the Moor that in dry seasons, when streams flowing from other sources become wholly or partially dried up, the Dartmoor water is sure to keep running." (*ibid.*) However, severe winters may still have caused problems to moorland leats. The UPV leats may have suffered, for example, in 1855, when severe frost halted Plymouth leat or in 1891, when the same leat was under heavy snow for six days. (Hawkings 1987, 25-6; Burnard 1891b, 43-4, plate opp.43)

The Construction of Leats

Preliminary survey of the course of the leat may have been done by professionals. For example, in 1800, a professional engineer, John Taylor planned the leats for Wheal Betsy near Mary Tavy and in 1833, a professional surveyor, John Hitchens of Tavistock was employed by Bottle Hill Mine. (Dickinson 1975, 105). The latter may well have supervised additional work on **Mon 47** in UPV. However, frequently the work was probably undertaken by the mine captain. (*ibid.*) It may be no accident that the "Mr Forsland of bovy", who in 1559/60 made the first survey of a possible route for fresh water to Plymouth, was a tin miner. (Hawkings 1987, 6)

Similarly, the construction work was probably often done by miners. For example, Walter Combes, a miner, who had worked at Eylesbarrow Mine between 1816 and 1820, also worked on leats at Owlacombe Mine in 1823 and in 1834. (Dickinson 1975, 106, 108) The clearing out of leat, **Mon 47**, which caused the dispute between Bottle Hill Mine and Trowlesworthy Warren, was carried out by a captain of the mine, Nicholas Fezzey (or Vesey) and a party of miners. (WDRO 72/949) (See below) Furthermore, much of the Devonport leat was dug by miners. (Hemery 1983, 138) The fact that miners were employed to survey and dig public leats suggests that they were the acknowledged experts.

Considerable precision is evident in the construction of some leats. For example, Engine Leat, **Mon 1075**, drops less than 8m in height over a total distance of 4520m. The small drop in height must have been intentional; for example, the instructions for digging a leat at Owlacombe Mine in 1835 stipulated that:

> "Some four miles of leat were to be finished within 3½ months at £134 per mile. The leat was to fall 1½ inches per chain, to be 2ft deep by 5ft wide." (Dickinson 1975, 105-6)

Presumably, the aim was to create a drop in height sufficient to allow water to flow adequately and to deter growth of weeds, but insufficient to erode the bottom and banks of the channel.

Most of the UPV leats are of relatively simple construction. Originally, they probably resembled the recently-recut Longstone Leat, **Mon 717**, in which the material excavated from the ditch has been piled up on the S downhill side. Often only a slight trace of the bank survives. It may have been preferable to provide a finished surface in the ditch. For example, at Owlacombe "the bottom and sides were to be of puddled clay two feet thick". (Dickinson 1975, 106) Excavation of a stamping mill at West Colliford, Bodmin Moor revealed clay lining in several phases of one of the leats and the steep-sided profile of a late phase of the same and another leat suggests that they had been lined with timber. (Austin *et al* 1989 84-5, 91-2) It is unlikely that the floor was ever cobbled or paved like parts of the Plymouth water supply leat. (Hawkings 1987, 15, plate 9) Some features may have required special attention. Particular care must have been taken at headweirs; a sluice was required to permit enough water into the leat but also to leave enough in the river. Marshall described the Headweir of the Plymouth Leat in 1796:

> "Across [the R. Meavy] a weir or dam is formed, of large rough stones with which the bed of the brook is thickly strewed. A paltry, ill-shapen wooden frame or floodgate, with a gully underneath it (through which most of the water passes), receives about half the waters of the Mew [Meavy]." (quoted in Hawkings 1987, 18)

Leats had also to be carried across minor tributaries and roads. An earthen bank, **Mon 1062**, marks the original passage of Longstone Leat, **Mons 1028** and **717**, across Drizzle Combe, 20m downstream from the present headweir. A weir carries leat, **Mon 47**, across Spanish Lake, while wooden launders may have sufficed elsewhere. Culverts conveyed Longstone and Engine Leats, **Mons 717** and **1075**, below the Sheepstor - Nun's Cross track. Leats may also have presented obstacles to the occupiers of the land. Thus a clapper bridge, **Mon 216**, noted by Haynes, was provided across the

Yeoland Consols Leat, **Mon 208**, while rabbit bridges across **Mon 47** were supplied by the warrener of Trowlesworthy himself. (Haynes' Maps LEG 11, TRO 6)

The construction of a leat would not require particularly sophisticated equipment. For initial surveying, a measured staff, in conjunction with a protractor and leadline would enable a level course to be followed. Harris suggested that even a bottle of water rolling on a plank, acting as a primitive spirit level, could suffice. (1968, 214) Sometimes, particularly in the shorter leats, the course could have been traced by "an experienced eye". The digging was probably done with mining tools, such as picks and shovels. Leats may have been excavated relatively quickly; four miles were expected to take 3½ months in the 1835 Owlacombe Leat. The twenty men observed working on the leat in October 1835 may have comprised the total workforce. (Dickinson 1975, 105)

After excavation of the leat, constant maintenance was required; frost, heavy rain or grazing animals could damage the banks and cause a considerable amount of water to be lost. For example in 1860 it was estimated that half the supply was escaping from the Wheal Emma leat during its 10-mile course from the R. Swincombe. (Barton 1968, 188) By 1891, it was calculated that 1/4 million gallons a day, out of a total 5½ million gallons, escaped from the Plymouth Leat, in the seven miles below Headweir. (Hawkings 1987, 28) Leats were also liable to silt up and excavations at West Colliford demonstrated that accumulated silts were repeatedly cleared out of the leats, both in the course of maintenance and in major re-cuttings after periods of disuse. (Austin *et al* 1989, 114-121) In 1817, a stretch of the Devonport Leat was choked by weeds which grew, according to a report, "so fast that one man cannot keep them under." (Hawkings 1987, 53) Thus it is possible that a leat keeper, such as Henry Honey at Vitifer in 1835, supervised the maintenance of UPV leats. (Dickinson 1975, 106)

Occasional major repairs may also have been undertaken in UPV. The renovation of **Mon 47** in 1859 must have involved substantial construction work, if, as reported by Rev. WI Coppard, the stone row, **Mon 42**, was almost demolished in order to supply building material. (Rowe 1896, 177)

Apart from recutting leats on new courses, such as **Mons 1053** and **1052**, **Mons 436** and **47**, and possibly **Mons 220** and **208**, which may have taken place after an interval of many years, some localised realignments are apparent. A fragment of an old course (**Mon 860**) of Bottle Hill / Lee Moor China Clay Leat, **Mon 47**, is visible where the present leat curves slightly downhill.

In addition to construction and maintenance, further expense may have been incurred in negotiating rent or in paying compensation. A charge may have been levied for the passage of a leat over a particular property (wayleave) or even for the water in the leat (water rent). Thus, in 1849, Devon Great Consols was permitted to take water from the R. Tamar for a payment to the Duchy of Cornwall of £250 a year, later increased to £450 and £460. (Booker 1967, 149-50) Dickinson notes that either wayleave or water rent was paid in at least nine Dartmoor mines in the 19th century. (1975, 103-5) Alternatively, compensation may have been offered for any inconvenience. For example, in the construction of the Plymouth Leat in 1591, £2 3s an acre was offered to landowners and tenants, or as an alternative, rights to the water supply. (Hawkings 1987, 7, 9, 11) In UPV, similar rents or compensation may have been paid for the passage of leats through warrens or open land.

It is apparent that the construction of leats was a constant source of disputes. Dickinson recounts the court action taken in 1835 over a leat for Owlacombe Mine driven through land belonging to Buckland House. (1975, 102-3) In UPV, a dispute over the Bottle Hill Mine Leat, **Mon 47**, is well-documented and may be representative of countless other disputes. (WDRO 72/949; 710/224,225)

In 1825, miners from Bottle Hill Mine under their captain, Nicholas Fezzey (Vesey), commenced clearing out an old leat within Trowlesworthy Warren in order to supplement the water supply for Bottle Hill Mine. However, in the course of this work, the rabbit warren was damaged and Nicholas Fezzey was charged with trespass by George Woollcombe, tenant of Trowlesworthy, on behalf of the warrener, William Nicholls. The case against Fezzey is reported in a paper prepared for Woollcombe's solicitor (WDRO 710/224) and details of the damage are listed in Nicholl's statement to the King's Bench. (WDRO 72/949)

The details are probably exaggerated; there is no evidence for the claim that channels, 10 yards wide, were cut. However, undoubtedly damage was done; in a letter, dated 21st July 1825, from Woollcombe's solicitor it was stated that:

> "already the pot water is cut off from the house, and we are informed that some rabbits have been drowned in their burrows." (WDRO 72/949)

The damaged pot water leat may be **Mons** 98a and b. Water may originally have been brought from Spanish Lake by leat **Mon 98a**, and conveyed to Trowlesworthy Warren House by **Mons 98b, 121, 135, 137** and **141**. The W end of **Mon 98b** is cut by leat, **Mon 47**.

Apart from damage caused by leats, disputes could also arise from competition for available water supply. Thus in 1593, owners of mills on the R. Meavy and Plym, complained that an insufficient flow of water remained once the Plymouth water supply was removed. (Hawkings 1987, 11) It is interesting to reflect that in *c.* 1825 - 1830, the Bottle Hill, Longstone, Engine and Stamping Mill Leats, **Mons 47, 717/1028, 1075** and **1052**, were all drawing water from the R. Plym basin and at times may have been competing for a limited supply. The Engine and Stamping Mill Leats may have been out of use when Phillips Leat, **Mon 520**, was constructed in *c.* 1835. It is also tempting to imagine conflicts in the 16th and 17th centuries between streamers on the R Plym, for example at Shabcomb (documented 1527), Harterhole (1562 - 1625) and Hartercombe (1589), and operators of the possibly contemporary stamping mills at Colesmills, Langcombe and Lower Hartor Tor. (WDRO 72/990/15; 72/990/34,60,65,77,84; 72/990/65) Even if these stamping mills were not contemporary with the streamworks, Brisworthy blowing mill (Documented 1560) certainly was. (WDRO 72/1033) A mill downstream from streamworks may have been handicapped by excessively silty water.

Finally, disputes arose when water was tapped illegally from leats. This may not have been a serious problem on the Moorland Plym. However, amicable agreements could be made with owners of major leats. (Hawkings 1987, 13) Thus Ditsworthy Warren House, which originally obtained domestic water supply from Drizzle Combe by the now disused **Mon 727b**, may later have rented a supply from the Longstone Leat, **Mon 717**. Ditsworthy pot water still flows from the Longstone Leat, via **Mon 727a**;

at one time a slate, bored with a hole of agreed diameter, known as an "ox-eye" or "bull's eye", may have regulated the flow, according to usual practice. (Hawkings 1987, 18; Robins 1984, 33) There is no evidence that a similar provision was made for Trowlesworthy Warren House from leat Mon 47.

6.1. Analysis of the survey data from UPV together with available environmental, excavation and documentary evidence has enabled the sequence of occupation to be traced from perhaps the Mesolithic to the present day. The catalogue of over 2000 entries provides descriptions of monuments in many categories for comparison with survey data elsewhere. However the discussion has concentrated on four periods or types of land use and the major conclusions within each category may now be summarised.

a) The provision of large-scale plans of all the hut-circles facilitated the more accurate measurement of internal area and orientation than previously possible and enabled the classification of structure types. Comparison of these variables supported O'Neill's conclusion (1983) that some hut-circles, principally those above the contour reave, were probably seasonally-occupied while characteristics of others, chiefly those below the reave, are consistent with permanent occupation. It was further suggested that some of the former may relate to an early phase of occupation, possibly associated with transhumance, and contemporary with some of the burial and ceremonial sites.

b) Analysis of the morphology, horizontal stratigraphy and overall plan of the Medieval field systems enabled the sequence of occupation at seven farms to be traced. Several phases were identified at Trowlesworthy, including a move eastwards from the earliest enclosed fields. The Phase II fields at Gutter Tor were demonstrated to have been enclosed by the occupants of Ditsworthy and the large field system on northern Hentor plain was suggested to be a 16th/17th century expansion of Hentor. The layout of boundaries on Ringmoor Down was shown to relate to pastoral use by farms within and beyond UPV. Documentary evidence contributed important chronological markers; thus the grant of Trowlesworthy in the early 13th century may mark the earliest post-prehistoric occupation of UPV. The desertion of Gutter Tor and "Rudemoor" in 1404 provides a *terminum ante quem* for these settlements and a *terminus post quem* for the enclosure of the Phase II fields at Gutter Tor.

c) Documentary references made the most significant contribution to the study of rabbit warrens. Examination of the series of Trowlesworthy documents finally laid to rest the oft-repeated claim that Trowlesworthy was a warren in the 13th century. It now appears that warrening was introduced to Trowlesworthy and Ditsworthy in the mid-17th century, probably by members of the same family. Furthermore parish records of vermin bounties suggest that vermin traps, a class of monument previously not closely dated, were introduced in the 1740's. The operation of the warrens was also assessed in the light of the field evidence.

d) In the discussion of tin-working an attempt was made to determine the different methods of extraction from the morphological distinctions within the field remains and from the study of documentary sources. Streamwork and openwork remains were interpreted following Gerrard's (1986) classification and individual tinworks were identified following Greeves (1981). Further, all the main shafts and routes of the adits of the 19th century Eylesbarrow Mine were identified with the aid of contemporary documentation. The field evidence for the processing of tin was also interpreted with the help of documentary sources. Discussion divided into early methods, focussed on the three mills on the R. Plym, and later methods exemplified by the complex of dresssing floors on Eylesbarrow Hill.

6.2. However the value of total landscape survey, covering all periods and types of land use goes beyond the conclusions which can be reached within each category. Thus the comparison of the distribution of monuments in each period can be a revealing exercise and the contrast between the location of three Medieval farms on Ringmoor Down and the restriction of the prehistoric settlement to the eastern margin is particularly striking. It is unlikely that all trace of prehistoric settlement further W would have been removed by Medieval farmers; several cairns, a stone row and a reave survive, while the presence of the latter suggests that the area had been sufficiently cleared to be suitable for occupation. It is, of course, possible that timber structures were used; suitable building stone may not have been available on this non-granite area. Otherwise, the implication must be that this area was reserved for a particular purpose, possibly valued, as it was later, as good grazing land.

Furthermore, the study of agricultural practdices identified in field and documentary evidence of the Medieval period in Devon can contribute to the interpretation of the prehistoric remains. The use of the Forest and Commons of Dartmoor as common grazing land by inhabitants of the moorland fringe and beyond since before Domesday is a well-known parallel for transhumance in the Bronze Age, possibly providing an explanation for the division of the moorland by the contour reave. In a further example, the value of small fields to intensive livestock management, noted in relation to the earliest Medieval phase at Trowlesworthy, compared to the use of open pasture for extensive pastoralism, was suggested as an appropriate explanation for the distinction between parallel field systems and open moorland in the prehistoric period.

Examination of contemporary activities can also reveal the relationship between them. For example, the study of farming in conjunction with warrening demonstrated that the "man named Nicholls", recorded by Crossing (1912, 432) as the farmer of Hentor in the late 18th century, was not the same person as "Peter Nicholls", who leased Hentor as a warren in 1807 and that, therefore, warrening did not commence in tandem with farming as might otherwise be concluded.

The relationship between tin-working and the agricultural community was identified at the outset as one area, in which total landscape survey could make a significant contribution. In one notable example in UPV, field evidence clearly demonstrates contemporaneity and co-operation between tinners and farmers. Thus the eluvial streamwork, **Mon 343**, which extends northeastwards from Legis Lake, carefully avoids the farmstead, **Mon 344**, and continues round the edge of a field, **Mon 342**.

Further co-operation is implied by the absence of any tinworks, even prospecting pits, above the valley bottoms on the open pasture as well as the enclosed fields of Trowlesworthy, Hentor and Ditsworthy farms. The location of tinworks obviously depends on the location of the deposits, but the contrasting number of pits and gullies on Ringmoor Down and Eylesbarrow and the gullies at Shavercombe, immediately adjacent to Hentor farm suggest that surface working was restricted to common land beyond the occupied tenements. The pits and gullies on the three

Ringmoor Down farmsteads may then post-date the desertion of these sites, and probably belong to the major phase of tinworking in the 16th and 17th centuries, documented in UPV and elsewhere. The association of the streamworks, Mon. 347, with "Leggers" tinwork, dated 1538, may then suggest that the contemporary occupation of the farmstead represents secondary re-use.

However it is difficult to establish whether such co-operation is a result of the pursuit of tin-working in conjunction with farming. Any tinning enterprise by the occupants of Trowlesworthy, Hentor and Ditsworthy would presumably be restricted to the margins of their farm and the tinners at "Leggers" could have been responsible for the secondary occupation of Ringmoor Down farmstead. Alternatively, co-operation could simply signify a close relationship between the tinners and their neighbours. On the understanding that tin-working "took place in a shared ... environment", some consideration for the farming community is to be expected from the tinners despite their extensive privileges. (Austin *et al* 1989, 20)

Thus the identification of tinning farmers (or farming tinners) may not be possible from surface indications alone. Excavation may provide further clues; thus the absence of pottery at East Colliford Mill, suggesting that the "workforce was sufficiently close to its domestic base not to need provisions or cooking equipment" may be consistent with a model of occasional tinworking by farmers or agricultural labourers. (Austin *et al* 1989, 228) By contrast the evidence for importing food, as well as for more complex processing at West Colliford Mill suggested a "more specialist workforce". (*ibid.*) Documentary evidence can also demonstrate links between farming and tinning, though mostly in the entrepreneurial class. Only Elie Shullibeare, who leased Ditsworthy in 1553 and was a stannator for Plympton in 1594, might be interpreted as a farmer with tinning interests.

Evidence for antagonism between farmers and tinners in UPV might provide a stronger indication that the two activities were practiced by different groups. It was suggested that the Phase II fields at Trowlesworthy were located further E to get away from the tin-working on the R. Plym. This could be interpreted as an effort by the farmers to accommodate the tinners or, alternatively, as a forced retreat. It is also possible that warrening was adopted as a less conflicting form of land use alongside tin-working. Antagonism is certainly demonstrated later, in the 19th century, notably in the dispute over the Bottle Hill Mine Leat on Trowlesworthy warren.

6.3. Finally only by total landscape survey can an attempt be made to construct the full sequence of occupation. The resulting sequence suggests that the history of the valley consists, not of a series of unrelated episodes but of a continuum. Evidence for the period between the Bronze Age and Middle Ages is still wanting but environmental evidence suggests that sheltered parts of the Upper Plym Valley may still have been grazed after the Bronze Age retreat, while Medieval use of the valley may be pushed much further back before the documented 13th century colonisation.

More importantly the field evidence demonstrates the great value of this tract of moorland. The extension of prehistoric enclosures, of Medieval field systems and of Post-Medieval rabbit warrens all testify to the success of these enterprises and value of the pasture. Moreover, other natural resources have been exploited; tin deposits may have contributed to prosperity from prehistoric times, water has been harnessed to drive machinery, large tracts of peat-cuttings indicate the importance of turf for domestic and industrial fuel and the granite itself has been put to multifarious use. Emphasis must, therefore, be made, not on the eventual retreat of prehistoric occupation, on the failure of Medieval cultivation or on the decline of the tin industry, but on the continuing value of the valley to the economy of Dartmoor and beyond. Like St. Neot parish on Bodmin Moor:

> "What has emerged .... is a story not of complete failure or of irreversible destruction, but of successful adaptation with occasional episodes of reversal and readjustment." (Austin *et al* 1989, 224)

APPENDIX A : SIZE AND STRUCTURE OF UPV HUT-CIRCLES

MON	SIZE	TYPE	STRUCTURE	MON	SIZE	TYPE	STRUCTURE
8	9.20	L	?2c; (3b); 4	111	46.9	K	(2b/2c); (3a); 4
10	13.83	N	5b	133	26.53	O	5c
12b	7.2	E	(2a); 4	148b	19.65	M	5a
12c	22.9	A	1a	148c	11.68	M	5a
12f	28.3	B	1b	148d	32.48	F	2a; 3a; 4
12g	?	B	1b	148e	24.60	F	2a; 3a/3b; 4
121	33.4	L	(2a); (3a/3b); 4	150a	36.35	F	2a; 3a/3b; 4
20b	?	L	(2a); (3a); 4	150b	17.93	F	2a; 3a/3b; 4
20c	51.2	K	(2a/2b); (3a); 4	150c	26.15	F	2a/2b; 3a/3b; 4
20d	11.0			156c	26.23	F	2a; 3a/3b; 4
20e	27.6	N	5b	156c	?		
29	17.75	A	1a	156e	?		
35	53.83	L	(2b); (3b); 4	171	37.23	G	2a; (3d); 4
43b	15.10	D	5c	173b	31.73	M	5a
44	5.35	O	5c	173a	?	A	1a
53b	13.60	K	(2b); (3b); (3d); 4	174b	27.60	A	1a
55	25.78	L	(2a/2b); (3a/3b); 4	174c	44.25	I	(2a); (3a); 4
56c	35.73	F	2a/2b; 3a/3b; 4	174d	27.68	K	1a/2a/2b; (3b)
56d	?	A	1a	196b	15.30	N	5b
56e	26.83	E	(2a); 4	211	20.45	F	2a/2b; 3a/3b; 4
56f	21.98	E	(2a); 4	223a	19.70	N	5b
60	48.95	G	2a/2b; 3b/3c; 4	224b	14.25	N	5b
62a	5.28	F	2a/2b; 3b; 4	224c	40.25	J	(2b); (3b); 4
64	46.98	F	2a/2b; 3a/3b; 4	224d	15.23	N	5b
69b	?	L	(2a); (3a); 4	225e	40.60	E	(2a); 4
70c	33.85	J	(2b); (3b); 4	226d	39.03	A	1a
70d	13.63	A	1a	226e	24.53	C	2a; 4
70e	24.35	K	2a/2b/2c; (3b); 4	226f	24.05	M	5a
70f	18.0	K	(2b); (3b); 4	226h	25.88	I	2a/2c; (3a); 4
71c	63.1	I	(2b); (3b); 4	2261	15.53	I	(2a); (3a); 4
86	28.88	E	(2a); 4	226m	19.40	M	5a
89b	17.24	N	5b	226n	21.95	F	2a/2b; 3a/3b; 4
91b	10.58	N	5b	227b	21.75	L	(2a); (3a); 4
101b	16.60	L	(2b); (3b); 4	227d	12.78	E	(2a); 4

MON	SIZE	TYPE	STRUCTURE
240	37.63	B	1b
241	18.25	K	(2b);(3b);4
242	16.30	B	1b
243	60.05	M	5a
244	15.75	E	(2a);4
245	37.08	K	245
?247	14.10	N	5b
248	20.20	M	5a
249c	11.38	B	1b
249d	31.53	K	(2a/2b);(3a/3b);4
249h	6.60	B	1b
250c	31.88	I	(2a);(3b);4
250d	28.05	M	5a
308	6.90	O	5c
309	69.00	O	5c
349b	39.10	L	(2a/2b);(3b);4
349c	48.30	H	(2b);3b;4
349d	25.93	F	2a/2b;3a/3b;4
349e	13.03	L	(2b);(3b);4;b
349f	40.68	I	2b/2c;3b/3c;4
349g	53.70	I	(2b/2c);(3b/3c);4
349h	2.33	N	5b
358b	25.05	D	(2a/2b);4
359c	6.53	L	(2b);(3b);4
359e	8.15	G	2b;(3b);4
360	18.58	F	2a/2b;3a/3b;4
361	18.65	G	2a/2b;3b/3c;4
362	29.78	L	?2c;(3a);4
364	27.25	I	(2b);(3b);(3d);4
365	28.28	L	(2b);(3d);4
366b	20.58	D	(2a);4
366c	17.50	N	5b
366d	15.55	L	(2b);(3b);4;6
366e	14.80	N	5b
376b	24.73	L	(2a/2b);(3a/3b);4
376c	12.75	F	2a/2b;3a/3b;4
376d	45.80	A	1a
382	5.58	N	5b
407	22.23	E	(2b);4
416	20.58	M	5a
417	12.68	M	5a
418	69.38	N	5b
419b	41.98	N	5b
422	10.48	N	5b
423	7.68	N	5b
424	30.98	N	5b
425	13.45	N	5b
442a	18.93	B	1b
442b	21.85	B	1b
446a	45.90	N	5b
446b	30.58	A	1a
449	17.23	M	5a
450	35.70	I	(2a/2b);(3a/3b);4
452c	10.75	L	(2a);(3b);5;6
452d	16.73	L	?2c;(3a);4
452e	9.45	M	5a;b
452f	9.15	M	5a;b
453a	18.73	G	2a;(3b);4
455g	13.75	L	(2b);(3b);4
455h	20.63	L	(2a);(3a);4
455i	24.63	K	(2b);(3b);4
455j	19.18	N	5b
461a	25.20	K	(2b);(3b);4
462b	38.30	L	(2b);(3b);4
462c	46.20	B	1b
462g	11.70	O	5c
463	11.40	N	5b
464	25.08	K	(2b);(3b);4
465	20.25	L	(2b);(3b);4
466	17.98	B	1b
467	21.70	A	1a
468	32.90	F	2a;3a;4
469c	10.00	N	5b

MON	SIZE	TYPE	STRUCTURE
469d	23.40	J	(2b);(3b);4
469g	23.20	B	1b
469h	43.40	I	(2b);(3a/3b);4
469m	10.00	B	1b
469q	8.90	L	(2a);(3a);5
469s	25.7	E	(2a/2b);4
469t	28.3	G	2a/2b;(3b);4
469u	27.1	L	(2b);(3b);4
490b	6.4	B	1b;6
490c	4.05	J	?2c;(3b);4
490d	5.8	M	5a
490d	4.88	E	(2b);4
490e	8.43	B	1b
490f	25.85	E	(2b);4
490g	4.18	E	(2a/2b);4
490h	17.75	F	2a/2b;3b;4
490i	11.60	L	(2b);(3b);4
490j	8.65	L	(2b);(3b);4
490k	8.43	L	(2b);(3b);4
490l	7.28	M	5a
490m	8.55	B	1b
490n	8.83	C	2a/2b;492
492	4.0	B	1b;5
496	4.5	B	1b;6
497	10.6	B	1b
498	6.98	B	1b;5
499	8.13	B	1b
500	22.98	O	5c;6
501	7.93	A	1a
502b	16.2	M	5a
502c	?	N	5b
504b	4.2	E	(2a/2b);4
504c	6.2	E	(2a);4
506	6.18	B	1b
507b	8.9	N	5b
507c	11.7	O	5c
507d	4.6	O	5c
507e	7.8	O	5c
508a	10.43	O	5c
508b	4.13	O	5c
508c	6.15	E	(2b);4
509	5.48	N	5b
510b	10.7	N	5b
510c	6.65	K	(2b);(3d);4
510d	6.63	B	1b
510e	11.1	N	5b
511	11.8	D	(2b);4
512	10.25	O	5c
513	12.03	O	5c
514	5.33	E	(2b);4
515a	4.38	N	5b
517d	4.33	N	5b
517e	3.83	N	5b
517f	14.18	N	5b
517g	6.33	L	(2b);(3b);4
517i	12.93	L	(2b);(3b);4
517j	8.0	E	(2b);4
517k	9.8	L	(2b);(3b);4
518b	24.5	K	(2b);(3b);4
518c	15.8	L	(2b);(3b);4
518d	24.58	J	(2b);(3b);4
518e	903	K	(2b);(3b);4
518f	9.63	N	5b
518g	9.38	L	(2b);(3b);4
518h	2.23	B	1b
525b	4.1	N	5b
527	9.8	E	(2b);4
528	9.13	N	5b
529	11.38	L	?2c;(3b);4
533b	11.5	O	5c
533	10.5	O	5c
533d	9.5	O	5c
546b	?	O	5c

MON	SIZE	TYPE	STRUCTURE
546c	15.4	O	5c
547b	12.28	O	5c
550a	8.05	O	5c
550b	4.5	O	5c
550c	10.23	O	5c
551	4.65	E	(2a);4
552	7.05	D	(2b);4
553a	9.48	O	5c
553b	?	O	5c
554	5.63	O	5c
555g	5.8	L	(2b);(3b);4
555h	5.08	L	(2b);(3b);4
555i	7.55	L	(2b);(3b);4
555j	12.05	N	5b
555m	2.05	O	5c
555n	5.68	O	5c
555o	6.93	O	5c
555p	8.2	O	5c
558i	7.25	O	5c
558ii	+5.63	O	
559	5.70	N	5b
560	2.30	O	5c
561	3.98	O	5c
562	4.95	O	5c
563	6.25	E	(2b);4;6
566	6.3	O	5c
567	30.9	N	5b
585b	30.68	L	(2b);(3b);4
585c	10.03	K	(2a);(3a);4
586b	13.25	J	?2c;(3b);4
588b	22.43	F	2b;3b;4
588c	5.2	N	5b
588d	21.28	F	2b;3b;4
588f	3.75	O	5c
588g	15.93	N	5b
588h	27.9	J	?2c;(3b);4
589b	22.68	F	2b;3b;4
589c	9.8	O	5c
589d	6.35	O	5c
589e	4.5	B	1b
589f	23.48	L	(2b);(3b);4
589h	28.45	M	5a
590c	26.48	L	(2b);(3b);4
590d	?	B	1b;5
590e	8.6	L	(2b);(3b);4
618b	32.68	O	5c
619	25.80	O	5c
621	21.73	O	5c
622	21.63	O	5c
623	24.95	O	5c
662	8.50	O	5c
663	52.93	O	5c
664	?	O	5c
665b	16.90	O	5c
665c	?	O	5c
670b	14.60	B	1b
670e	20.75	B	1b
670f	8.85	O	5c
670h	25.0	G	2a/2b;(3b)
751a	12.05	D	(2b);4
752a	14.10	L	(2a/2b);(3b);4
752b	15.95	A	1a
753a	11.98	L	(2b);(3b);4
753b	13.80	K	(2b);(3b);4
754	13.50	L	1b;(2b);(3b)
755	5.43	L	(2b);(3b);4
756	26.30	L	(2a/2b);(3b);4
757	14.03	L	(2b);(3b/3c);4
758	7.28	B	1b
759	25.73	I	(2a);(3a/3b);4
760	16.30	K	(2b/2c);(3b);4
761	4.43	L	(2b);(3b);4
762	4.75	B	1b
763a	19.68	K	(2b/2c);(3b);4

MON	SIZE	TYPE	STRUCTURE
764	23.20	E	(2a/2b);4
765a	22.70	K	(2b/2c);(3b);4
766a	29.55	L	(2b);(3b);4
767	12.00	I	(2a/2b);(3b);4
768a	17.03	F	2a/2b;3a/3b;4
769a	6.25	L	(2b);(3b);4
769b	34.83	J	(2b);(3b);4
?769c	16.33	A	1a
770a	15.58	N	5b
771a	2.80	B	1b;5
772	?	L	(2b);(3b);4
773	12.15	J	?2c;(3b);4
774	15.88	I	(2b);(3b);4
775	25.80	L	(2b);(3b/3c);4
776	10.48	L	(2b);(3b);4
777	21.15	L	?2c;(3b/3c);4
778	6.95		?
779	5.40	C	2a/2b;4
790	18.98	E	(2a);4
781	4.18	E	(2b);4
782	7.33	G	2b;(3b);4
783	?		?
784	?		?
817b	7.33		(2b);(3b);4
?817c	11.03	A	1a
817d	18.40	L	(2b);(3b);4
817e	21.05	E	(2b);4
819b	24.68	L	(2b);(3b);4
819c	?	O	5c
819d	13.70	D	(2b);4
819e	15.58	L	(2b);(3b);4
819f	4.60	L	(2b);(3b);4
823b	222.60	J	(2b);(3b);4
824b	11.85	G	2b;(3b);4
824c	20.28	L	(2b);(3b);4
824d	27.98	K	(2b);(3b);4
824e	23.75	F	2b;3b;4
826	17.78	E	(2a/2b);4
827	24.60	L	(2b);(3b);4
828	24.78	I	(2b);(3b);4
829	10.90	L	(2b);(3b);4
830	24.30	L	(2b);(3b);4
886b	28.83	A	1a
887b	19.20	B	1b;6
887c	23.68	A	1a
888b	38.25	B	1b;6
888c	21.75	B	1b
904b	24.80	F	2a;3a;4
904c	18.85	C	2a/2b;4
913	29.33	J	(2b);(3b);5
937	7.78	O	5c
940N	?	O	5c
940S	?	O	5c
?944	15.88	N	5b
945	38.30	O	5c
?948	?	O	5c
?949	?	O	5c
950	17.68	O	5c
951	17.40	O	5c
952c	?	O	5c
952d	?	O	5c
952e	9.55	O	5c
964b	4.40	B	1b;5
964c	?	B	1b
977	24.88	O	5c
997b	?	O	5c
997c	?	O	5c
997d	?	O	5c
997eN	?	O	5c
997eS	?	O	5c
998	?	O	5c
999	9.40	O	5c
1000a	?	O	5c
1000d	?	O	5c

MON	SIZE	TYPE	STRUCTURE	MON	SIZE	TYPE	STRUCTURE
1000e	?	O	5c	1078e	19.05	E	(2b);4
1000f	?	O	5c	1078f	9.35	L	(2b);(3b);4
1000f	?	O	5c	1078g	14.93		?
1001b	15.40	O	5c	1087b	33.33	D	(2a);4
1002b?	O	5c		1087c	52.63	L	(2a);(3a)
1021c	4.58	O	5c	1087d	14.33	L	(2a);(3a);5
1021d	7.85	O	5c	1087e	4.25	O	5c
1021e	3.28	O	5c	1110b	7.33	L	(2b);(3b);4
1034b	?	O	5c	1110c	18.55	B	1b
1034c	?	O	5c	1110d	7.05	O	5c
1035	21.55	L	(2b);(3b);4	1110e	8.25	O	5c;6
1036	47.83	L	(2b);(3b);4	1120b	14.48	E	(2b);4
1037	34.10	O	5c	1120c	11.45	B	1b
1039b	12.18	L	(2b);(3b);4	1122c	10.18	O	5c
1042d	?		?	1122d	12.78	M	5a
1042e	14.40	D	(2a/2b);4	1122e	11.30	O	5c
1042f	19.70	G	2a/2b;(3b);4	1122f	16.20	N	5b
1047	9.60	K	(2b);(3b);4	?1172a	15.60	E	(2b);4
1048	10.03	D	(2b/2c);4	?1172d	10.25	E	(2a/2b);4
1050c	73.3	L	?2c;(3b);4	1173c	10.65	L	(2b);(3b);4
1050d	4.7	L	(2b);(3b);4	1173e	5.20		?
1050e	8.8	L	(2b);(3b);4	1173f	10.83	D	(2b);4
1050f	36.8	L	(2b);(3b);4	1179b	8.08	O	5c
1050g	24.2	L	(2a/2b);(3a/3b);4	1179c	11.0	O	5c;6
1078c	12.6	L	(2b);(3b);4	1179d	11.2	E	(2a);4

APPENDIX B : FORM AND FUNCTION OF TITLE DEEDS.

DEED	FUNCTION	UPV EXAMPLES
"Gift" or "Feoffment"	Records, not a free gift, but the transfer of ownership, which had taken effect with the transfer of "seizin", which was an actual part of property, eg. a key or a piece of turf. (Dibben,1968,4,5)	WDRO 710/01 WDRO 710/02
"Letter of Attorney"	Records transfer of seizin, undertaken by an intermediary or "attorney", appointed by the vedor or purchaser. (Dibben,1968,64). Could be as seperate document or included in the deed of conveyance.	WDRO 710/09 WDRO 710/10 WDRO 710/11
"Bargain and sale"	Developed after 1535 from the gift; seizin was no longer necessary but the transaction had to be enrolled, either at Westminster on Close Rolls or at a local court on Quarter Sessions records. (Dibben,1968,9; Alcock,1986,53)	WDRO 710/07 WDRO 710/09 WDRO 710/11
"Fine" or "Final Concord"	Developed out of the emphasis on establishing rights to a property. Recorded a lawsuit (initially an actual case in the Court of Common Pleas, but later simply a fictitious one),taken to demonstrate the purchaser's ownership. (Dibben, 1968,17) Recorded in the Feet of Fines at Court.	WDRO 710/03
"Lease and Release"	Two-part deed, which developed after *c.* 1600 and allowed greater privacy than the seizin ceremony, the enrolment of the bargain and sale and the recording of the fine. In the first part, the vendor leases the property to the purchaser for one year at a nominal rent and on the following day,the vendor releases his rights to the purchaser for a "consideration", ie., a sum of money. (Alcock,1986,42; Thoyts,1893,59)	WDRO 710/16
"Deed of Common Recovery"	Counteracts an earlier title deed, which required a property to "descend in the family", so that property could be sold or included in eg.a marriage settlement. Takes the form of a lawsuit.	WDRO 710/21 WDRO 710/22
"Quitclaim"	Relinquishes any claim to a property.	WDRO710/12-13 WDRO 710/17
"Marriage Settlement"	Settlement of property on the parties to a marriage.	WDRO 710/23 WDRO 710/126
"Lease"	Provides for the letting of property.	WDRO 70/183 WDRO 70/189 WDRO 70/247 WDRO 710/4-6 WDRO 710/08 WDRO710/14-15 WDRO710/19-20
"Mortgage"	"A pledge of property as security for the repayment of money borrowed. (Beds.Co.Co., 1988,42) Taken out after *c.* 1600.	WDRO 710/18

APPENDIX C : DOCUMENT EXTRACTS

Document Extract 1

Gift from Baldwin de Riparis [de Redvers] to Sampson de Traylysworthy
Early 13th century (WDRO 710/1; 710/748)

Know [men] present and future that I Baldwin de Riparis Earl of Devon have given and granted and by this my present charter confirmed, to Sampson de Traylysworthy and his heirs and assigns for his homage and service all the land of Traylyswurthy with its appurtenances .... by these named boundaries to wit: just as Penickes Lake comes into Thickstone Lake itself also Thickstone Lake descends into Blackabroke and thus .... Blackabroke descends as far as Plime And in the east part by the middle of the turbary of Eastor as far as the flowing spring of Eastorbrooke And thus by the river of the spring as far as Estorbroke and thus by Estorbroke as far as Plyme And thus the water of Plime descends as far as Blackabrook. TO HAVE & TO HOLD to him and his heirs and assigns of me and my heirs freely and quietly peacably wholly by hereditary right forever. RENDERING thereof annually he himself & his heirs & assigns to me & my heirs 4 shillings at the four terms of the year namely at the birth of our lord XIId at Easter XIId at the birth of St John the Baptist XIId and at the feast of St Michael XIId for all service suits and demands. I have granted moreover to Sampson & his heirs & assigns common of pasture in all my wastes & of my heirs & housbote & folebote in my wood of Bikelegh as long as the same is required. And I Baldwin & my heirs to the said Sampson & his heirs & assigns all the aforesaid lands with appurtenances against all people to hold do warrant forever. This [may hold] it firmly and steadfastly. To these present deeds I have put my seal. These [being] witnesses Richard of Meavy, Herbert of Spineto, Roger of Cadewych, Walter Pomeras of Goodameavy, Alex of Hemmerdon, Walter of Plimpton, Thomas of Challeswiche, Simon Ellewille & many others.

Document Extract 2

Lease determinable on four lives, 1404 (WDRO 710/3)

This indenture witnesses that Robert Hulle, Ralph Hulle, John Fortescue & John Jaycok have leased and granted to John Halswill & Eleanor his wife all their messuages lands and tenements in Tranaylesworthy Holrede Cadeworthy & Lulleworthy with appurtenances which the aforesaid Robert Ralph John Fortescue & John Jaycok [conveyed] as a result of a gift and grant to the aforesaid John Halswill & Eleanor from a fine raised in the court of the lord King Henry IV. TO HAVE AND TO HOLD all the aforesaid messuages lands and tenements with appurtenances to the aforementioned John Halswill and Eleanor for the whole lives of John and Eleanor themselves so that after the deaths of the aforesaid John Halswill and Eleanor the aforesaid messuages lands and tenements with appurtenances shall pass to William the son of John and Eleanor for his whole life in full so that after the death of the aforesaid Willi the aforesaid messuages lands & tenements with appurtenances shall pass to John the son of the aforesaid Willi for his whole life in full. TO HOLD from the aforesaid Robert Ralph John Fortescue & John Jaycok & the heirs of Robert himself. IN WITNESS whereof their seals were affixed interchangeably to this present aforesaid indented charter these being witnesses Richard Piperell William Fortescue Ph Botford John Crokker John Siverlok William Carslake and many others. GIVEN at Traylesworthy on the first day of April in the fifth year of the reign of King Henry IV afetr the Conquest.

Document Extract 3

Bargain and Sale, 1550 (VDRO 710/7)

This indenture made the fowreth day of January the thirde yere of the reign of our sovereign lord Edward the sixth by the grace of God of England France & Ireland Kyng defender of the faith, and yn y'earth of the church of englande & Irelande supreme head. BETWEENE John Crokker of Lyneham yn the Countie of Devon esquier of th'one partie, and Alyce Harrys late the wyef of Nicholas Harrys of Shaue in the said Countie Vydowe of th'other partie VITNESSETH that whate[ve]r the leases bargaynes goods and ?chattels of the said Nicholas amonge oders [others] by reason of his disobedience & rebellion contrarie to his naturell dutie of liegeance yn the late styer [stir] & comocon [commotion] yn the said Countie forfeited and to our sovereign lord the kyng confiscated yn consideracon [consideration] of the trew faithful and right acceptable servyce by George Crokker and oders [others] his fellowes .... to the right worshipful ?th'archdeacon .... gentilman agenst the rebellyon their done were by lawful warrant bearing date the nyneth daye of August last passed to them especially appoynted & yeoven as a forfeit to be taken of the kynge .... mere .... and free gyft by waye of reward according to his .... p[ro]clamacon [proclamation] bearing date th'elewynth daye of Julye the yere aforesaid. TO HAVE and [to hold] the seide leaser & bargayner during the time & times of the said Nicholas of and in the same, and the said goods and ?chattels forevermore. AND THEY by force thereof of the premysses lawfully possessed and reallys [release] herof beying in possession according to the said warrant as owner of the same for a certayne some of money by saide John Crokker to them trulye co[venant] & payd granted bargayned alyenated & clarely [clearly] sold to the said John Crokker all and singular the ?premises he to have & enjoy the same in like & sembable man[ner] according to the full effect of the said ?gift & warrant by reason wherof the said John Crokker nowe hath and of ?verrey right ought to have the same as verrey ?own[er] therof. THAT the said John Crokker for the some of one hundred markes of lawfull money of england by the said Alyce to the said John in hand trulye payd which the said John ?knowyth himself to have ?received of the said Alyce and therof ?clearly acquitteth & utt[er]ly dischargeth her by these presents: ?doth ?graunt bargayne alyene [alienate] and by this indenture clearely sell to the said Alyce all and singular the said leases bargaynes goods and ?chattels, as late belonged to the said Nicholas withyn the said Countie, and all his right, title, use, and interest of and yn the same. TO HAVE hold use possess occupye and enioy all the said leases bargaynes goods and ?chattels to the said Alyce her executors and assigns to her & their owne .... use and behof [behoofe] and as ther .... as fully and yn as ample and large man[ner] as the said John, George, and th'others with hym yn the said warrant named, they or any of them by vertue therof or the said Alyce by any man[ner] title cause use conveyhance other than myght, if such forfituture .... nev[er] bene .... AND THE said John Crokker for hym his heires executors and admynistrators & any of them ?doth ?specially covenant promyse and give to & with the said Alyce by these presents that they & any of them all and singular the said leases bargaynes goods and ?other the ?premysses to the aforesaid Alyce her executors administrators and assigns agenst al man[ner] of people shall warrant & defend and them & any of them shall .... & .... for the same, and of, for and from all and al man[ner] ?debtes whatsoever by the said Nocholas due, and therof shall from tyme to tyme, and at all tymes ?acquit execute and ?clearely discharge them & any of them agenst al man[ner] of persones at the .... & .... and .... of the said John Crokker his here [heirs] executors and admynistrators by these presentes. IN WITNESS wherof both the .... parties to these presents .... have putte their seales. Yeoven [given] at .... the day and yere first above written

Document Extract 4

Bargain and Sale, 1560 (WDRO 710/11)

To all the faithful of Christ to whom this present writing will come John Crokker of Lyneham in the County of Devon senior, esquire sends greetings in the Lord everlasting. You will know me the aforesaid John Crokker .... in consideration of one hundred marks lawfull money of England to me the aforesaid John Crokker .... William Wolcombe of Plympton Mary in the county aforesaid yeoman before sealings .... good & faithful payment & ?whatsoever. William Wolcomb his heires executors & administrators .... & .... to be by these presents to have given granted & by this my present writing confirmed to the aforesaid William Wolcomb all those messuages lands tenements meadows pastures & grazings woods underwoods rents reversions & services of all other hereditaments .... with their appurtenances called Traylesworthy alias Trayllesworthy situated ?lying & ?being in the parish of Shahe in the aforesaid county of Devon lately in the tenure of the aforesaid William Wolcombe or his assigns which all and singular premisses with their appurtenances forever purchased for me & my heirs from the late John Hele. TO HAVE AND TO HOLD all the aforesaid messuages lands tenements meadows pastures & grazings rents reversions & services of all other premisses previously pronounced & specified with their appurtenamces to the aforesaid William Wolcombe his heires assignes forever to .... & .... to the same William his heirs & assigns forever from the chief lords of that fee for the rents & services thence due and of right accustomed. AND I TRULY the aforesaid John Crokker & my heirs all the aforesaid premisses previously pronounced & specified with their appurtenances to the aforesaid William his heirs & assigns lately ?against all people will warrant discharge uphold forever by these presents. .... me the aforesaid John Crokker to have appointed attorned deputed & in my stead place the beloved in Christ William Frenche ?junior Robb.. Hongiston for me truly & legitimately attorn all the aforesaid messuages lands tenements & .... premisses with their appurtenances

....

Document Extract 5

Extract from the Deed of Amicia, Countess of Devon:

The Boundary of Buckland Abbey (translated in Brooking Rowe 1875, 355)

"from the Loppapilla [Lophill (Ref. 1 p. 496)], on the western part of Bocland towards the north and east, through the middle of the water of Tavy, and from Walkhampton to the boundaries of Dartmoor, on the northern part of Mistor [Mistor], and thence towards the South by the boundaries of the Verderers (regardorum) of Dartmoor, that is to say, by Mistorhead (Mistor panna), and by Hysfochres [North and South Hessary Tors] , and by Siward's Cross [Nun's Cross] and Gyllesburgh [Eylesbarrow] and Plymcrundla [?Plym Steps (Ref. 3 p. 239); ?tinworks at Crane Lake (Ref. 5 p. 280)] to the Plym, and thence by the Plym towards the west to Yaddabrook [Legis Lake (Ref. 1 p. 509)], and so by the bounds which surround Rydemore [Ringmoor Down] and Smalacumba [Smallacombe], that is to say, by the old ditch to the angle of the ditch of Yllalonde [?corner of Brisworthy Plantation], and thence by Hurtwallen [?western boundary of UPV] to Smalacumbacrosse [Marchant's Cross (Ref. 2 p. 64); Ringmoor Cottage (Ref. 7 p. 203)] and Smalacumbalak [Smallacombe Brook], and by the water course of Meavy to Olyak [on the R Meavy possibly near Yeo (Ref. 1 p. 499)], and by the ditch to the road which leads from Plympton to Schitestor [possibly Portland Lane], and so by the stone bounds to Biracumbaford [ford near Burcombe Gate (Ref. 4 p. 169)] and by Crewecumba [Outcombe Brook (Ref. 4 p. 154)], and Denebrok [Narrator Brook (Ref. 1 p. 490)], and [along] the course of the river Meavy to Schollaford [possibly now under Burrator Reservoir], and so by the old boundaries to Yanedonecross [a broken cross at Yennadon Cross junction at SX 545 695 (Ref. 6 p. 46)], and thence by the bounds to Stoford [near Dousland (Ref. 1 p. 504)] and Lake [SX 531 682] and Churcheford ["where the lane from Yelverton to Meavy crosses a brook coming South from Lake farm" (Ref. 1 p. 487)], and by the divisions between Elleford [Elfordtown (Ref. 1 p. 490)] and Crosseton [Gratton (Ref. 1 p. 489)] to Elfordlak [the tributary from Elfordtown to River Meavy (Ref. 1 p. 490)] and to the course of the river Meavy, and so to the place where the Meavy falls into the Plym, and along the Plym towards the divisions of Hescombe [Harscombe (Ref. 1 p. 493)], and to the cross roads beyond Purpris [Purps farm (Ref. 1 p. 499)], and thence by passing along the way which leads from the Cadaworth bridge [Cadover Bridge] to Plympton through the land of the Schagh

[Shaugh] towards the east as far as Shitaburgh [Saddlesborough (Ref. 1 p. 502)], and thence by old bound-stones to Haneketorr [Hawk's Tor (Ref. 1 p. 492)], and thence towards the west and north through the land of Farnhill [Fernhill (Ref. 1 p. 491)] to Maynstonktown [Mainstone (Ref. 1 p. 497)] and Maynstoncross and Horingbrook [Hurrabrook (Ref. 1 p. 494)] and to Writewillak [near Pethill (Ref. 1 p. 509)], and thence by a certain footpath to Pudehel [Pethill (Ref. 1 p. 500)], including Southpudehel, and so along the bounds towards the east to Horsford [ford over brook, N of Pethill (Ref. 1 p. 494)], and thence along the ancient metes to Writewill and Horyngbrok, and so to the Plym and to Wolewillebroke [Woolwell (Ref. 1 p. 508)] and to Wolewille Cross, and thence by the road which leads from Sutton to Tavistock at Copriscrosse, and thence towards the north along the ancient ditch to Bycacumbayoneda [Bickham (Ref. 1 p. 487)], and so along the ancient bounds to Loppapilla [Lophill (Ref. 1 p. 496)]..."

Refs. 1. Burnard and Prowse 1893; 2. Crossing 1892; 3. Gover, Mawer and Stenton 1931; 4. Hemery 1983; 5. Somers Cocks 1970; 6. Starkey 1989; 7. Worth 1942b

Document Extract 6

Hentor Warren Agreement (WDRO 582/11/2)

The Right Honble John, Lord Boringdon to Peter Nicholls of Sheepstor, Warrener 29th Sept. 1807

Lord Boringdon granted upon lease "All that part parcel and portion of a certain common called or known by the name of Lee moore situate and lying in the Parish of Shaugh in the said County of Devon according as the same is now meted and bounded out from the said Common of Leemoore in manner following (that is to say) from a certain row or heap of stones joining Trowlesworthy Warren and Spanish Lake Head ... about forty land yards above the same to a large Rock marked with the initials H.W.B. No. 1 from thence straight on East to another stone marked No. 2 Eighty yards above the said row or heap of stones from thence in a straight line to another bound stone marked No. 3 which is forty yards South of the large upright rock in Hentor Tor from thence to the Head of Shabbacombe Lake ... to another bound stone mark No. 4 from thence in a straight line to Colesmills (formerly a Stamping Mill) adjoining the River Plym to another bound stone marked No. 5 ... and which said stones are in all other respects bounded by the Tenements called Willings Walls and Hentor in the said Parish of Shaugh and are now in the possession of the said Peter Nicholls as Tenant thereof with free liberty and power for the said Peter Nicholls, his executors to keep Dogs Guns Traps Nets and other Engines and snares for the destroying of Foxes and other Vermin and to employ the said Lands within the Bounds aforesaid for the run of Rabbitts as long as the same shall remain uninclosed by the said John, Lord Boringdon, his Heirs or Assigns and there to Hunt by Ferretts and Pitch Nets as is usual and customary in such cases for the most benefit and advantage of the said Peter Nicholls, his Executors etc ...

...To have and to hold use and advantage of the said waste for Term of 50 years upon the life of Mary Frances Penson, Widow formerly of Totnes.

Rent. Peter Nicholls to pay £5 per year at the usual feasts in equal portions...

Document Extract 7

Account of Capt. Gregory's inspection of Two Brothers' Adit, Eylesbarrow Mine, 5th July 1847. (MJ 10.7.1847)

"I have this day been underground; as we had a run. I assisted the men in securing it; and, as soon as the water was let down, so as to make an entrance east from Henry's shaft, I took two men, and prosecuted east to the next whim-shaft, where we found the adit to be quite clear as if we had been here employed, instead of being idle for years; we then started east as far as the new engine-shaft - that is where the large lift of pumps are above the mansion-house; here I find the old leaders, timber and rubbish, to have filled the bottom of the shaft; again I proceeded with my little party to the old engine-shaft, or the first whim, on top of the hill, where i find some timber wanted, but of no great quantity; and, lastly, I went up to near Henry's engine-shaft, which is not 100 fms from our object in view, Pryse Deacon's shaft, where I find the back of the level to have giving way, and the water is coming through the fill of rubbish, but this is only trifling. We may now say, our adit is all but clear from the tail to near Pryse Deacon's shaft, which is upwards of 600 fms, and that without any serious expense. As we have been so fortunate with the adits, we shall I hope be in readiness for the engine in eight or nine weeks, excepting the repairs in the shaft; and as the weather is so fine, it will not be long re-building; I am positive we shall soon complete the adit."

T. Gregory July 5

APPENDIX D : LIST OF DOCUMENTED TINWORKS IN THE UPPER PLYM VALLEY

ALLHALLOUBEAME Greeves No 6

"Lying upon the very Rudge of the hill above Hentor hill Shabbercombe and Colemorerudge streaming towards Yealm". (WDRO 72/1034)

1. Richard Hele and Strode pitched it for void ground in 1601. (*ibid.*)2. Hele and Strode owned ½ each in 1625. (*ibid.*)

3. Sir Richard Strode acquired ½ share in 1639. (WDRO 72/990)

COLEMOORE RUDGE / COLEMORE RUDG Greeves No 172

"Lieing uppon the hill on the South side of Plimm betweene Langcombe and Shabbercombe". (WDRO 72/1034)

1. Strode acquired 1/6 part before 1625 from Thomas Bayliffe who pitched it for voyd ground. (*ibid.*)

2. John Woollcombe of Shyttistor gave possession of 1/6 part to Sir Richard Strode in 1639. (WDRO 72/990)

CRANELAKEHED [Cranelakehead] Greeves No 195

1. John Tome of Shaugh, Tinner gave possession of 1/3 part to Sir Richard Strode of Newingham, Knight in 1640. (WDRO 72/990)

CRANE LAKE MINE

1. A streamwork had "only recently been opened" in 1792. (Cook *et al*, 1974,164)

DEEPEWORK, NORTH: DEYPEWORKE,NORTH: DEEPWOURKE,NORTH Greeves No 221

1. Alexander Webbe gave possession of 1/3 part to Bernard Webbe and Michael Webbe in 1560. (WDRO 72/990/33)

2. Bernard Webbe gave possession of 1/4 part to Jon Veyn in 1573. (WDRO 72/990/39)

3. Henry Woollcombe of Shittestor, gent. gave possession of 1/6 part to Sir Richard Strode of Newingham, knight in 1642. (WDRO 72/990/91)

DEEPEWORKE, SOUTH Greeves No 222

1. Henry Woollcombe of Shittestor, gent. gave possession of 1/8 part to Sir Richard Strode of Newingham, knight in 1642. (WDRO 72/990/91)

DRUSSELCOMBE,GREATE; DRUSSELCOMBE HEDD; THROSSTELCOMEHEAD — Greeves No 241

1. Wm Rede of ?Ugboroughe, Tynner gave possession of 1/8 part to ?William Weydlacke in 1593. (WDRO 72/990/70)

2. Referred to in 1628 and 1629. (Greeves 1981, 315)

DRUSSELCOMBE, LOWER; DRUSSELCOMBE FOOTE — Greeves No 242

1. Referred to in 1628 and 1629. (Greeves 1981, 315)

FADABROWKE — Greeves No 245

1. Referred to in 1589 and 1633. (Greeves 1981, 316)

EVILL,GREAT; EVELL,GREAT — Greeves No 253

1. Windyeat of Dencombe and Windyeat of Middleworthie in the parish of Walkhampton gave possession of 1/4 part to John Elford, son of Walter Elford of Shipstor [Sheepstor] in 1611. (DRO DD 1342)

2. Referred to in 1705. (Greeves 1981, 316)

HEVELL BEAME,GRET; EVILL BEAME — Greeves No 254

1. Thomas Smythe of Shurver [?Shaugh] parish gave possession of 1/8 part to John Elford the younger and John Bounsall the younger in 1563. (DRO DD4349)

<u>EYLESBARROW</u>

ELLESBOWRRE; YELLSBORROW; YELSBORROW; YEALESBOROUGHE, EASTER; YELSBOUR, EASTER & WESTER — Greeves No 255

1. Thomas Smythe of Shurver [?Shaugh] parish gave possession of 1/8 part of Ellesbowrre to John Elford the younger and John Bounsall the younger in 1563. (DRO DD 4349)

2. Tinworks called Easter Yealesboroughe were said to adjoin tinworks called Lyttleholt in 1599. (DRO DD1357)

3. George Higgines of Cornwood, tinner gave possession of "a third parte mine of a twelfeth called Blactor [?] in Wester Yelsbour" and "the third part of two doles the whole work being nine doles in Easter Yelsbour" to William Wicocke of Shittestor [Sheepstor] in 1660. (DRO DD 4350)

4. Referred to in 1671. (Webster 1671, 290-2)

ELLISBOROUGH TIN MINE; DARTMOOR CONSOLIDATED TIN MINES

1. 1814 - 1852. (WDRO WW20a and b; WW21; Cook *et al*,1974)

WEST ELLISBOROUGH

1. Sett granted 1823. (WDRO WW20a, WW21)

SOUTH ELLISBOROUGH

1. Sett granted 1823. (WDRO WW20a, WW21)

RINGMOOR DOWN

1. Sett granted 1823. (WDRO WW20a; WW21)

WHEAL KATHERINE

1. Sett granted 1817. (WDRO WW 20a; WW21)

FOXTER MARISHE Greeves No 278

"The Hedweare lieing att the easter end of Trowlesworthy wast uppon a Rocke about 3 arrowshotts upp from Plim by the west side of Yeasterbrooke bounding uppon the east sid and north side with yeasterhill and the River of Plimm full to trowlesworthy yeate by eadabroake Foote where is the tayle it boundeth one the south side with a Tynworke in Trowlesworthy ground". (WDRO 72/10340

1. Pitched by Alexander Elford in 1601. (*ibid.*)
2. Strode owned 1/4 part, John Elford 1/4 part and 1/8 part and Alexander Elford, Junior the rest in 1625. (*ibid.*)
3. John Woollcombe of Shyttistor gave possession of 1/4 part to Sir Richard Strode in 1639. (WDRO 72/990)

GOTTERKNAP Greeves No 321

1. Thomas Blancherd gave possession of 1/5 part to Baldwin Hele of Shaght [Shaugh] in 1539. (DRO DD 1346)

GREINEWILL Greeves No 327

1. Referred to in 1625; see Wenfford. (WDRO 72/1034)

GRIDDLEFORD Greeves No 331

1. Referred to in 1625; see Yeasterhill. (WDRO 72/1034)

HARTERCOMBE Greeves No 350

1. Phillippe Ludbrooke als Dimvidge gave possession of 1/6 part to Thomas Baylie of Shepistor, tynners in 1589. (WDRO 72/990/65)

HARTERHOLE Greeves No 351

1. Tho Smith gave possession of 1/6 part to Walter Graye in 1562. (WDRO 72/990/34)

2. Walter Grayes of Buckfastleigh, tynner gave possession of 1/12 part to Philip Strode of Plimpton in 1585. (WDRO 72/990/60)

3. Referred to in 1589; adjoined Hartercombe. (WDRO 72/990/65)

4. John Am gave possession of 1/12 part to Philip Strode in 1599. (WDRO 72/990/77)

5. John Woollcombe gave possession of 1/6 part to William Strode, gent. in 1625. (WDRO 72/990/84)

HENTORHILL Greeves No 390

"The Hedweare lying att the Topp of the Hill above Hentor Torr bounding on the west side with Woulterbrooke and on the eastside with Shabbercombe streaming into Hentormeade." (WDRO 72/1034)

1. Pitched in 1601 by Richard Hele and Strode, ½ each. (*ibid.*)

2. Richard Hele and Strode owned ½ each. (*ibid.*)

3. John Woollcombe of Shyttistor gave possession of ½ part to Sir Richard Strode in 1638. (WDRO 72/990)

HENTOR MEADE; HYNDTOR MEADE Greeves No 391

1. Richard Strode gave possession to Francis and Richard Strode in 1527. (WDRO 72/990/15)

2. Referred to in 1625; see Hentorhill. (WDRO 72/1034)

LANGCOMBE Greeves No 457

1. Referred to in 1625; see Colemoor Rudge. (WDRO 72/1034)

LEGGERS Greeves No 466

1. Richard Strode gave possession to John Strode in 1538. (WDRO 72/990/21 and 22)

MIDDLE PLYM

1. Thomas Deane of Plympton St Marie, Tynner gave possession of 1/8 part to Philippe Strode of Shaugh, gent in 1599. (WDRO 72/990/31)

SHABCOMB; SHABERCOMB; SHABBERCOMBE Greeves No 659

[Shavercombe]

1. Richard Strode gave possession to Francis and Richard Strode in 1527. (WDRO 72/990/15)

2. Walter Redes gave possession to Francis and Richard Strode, Junior in 1532. (WDRO 72/990/17)

3. Referred to in 1625; see Hentorhill. (WDRO 72/1034)

TROWLESWORTHY Greeves No 745

1. Referred to in 1625; see Foxter Marishe. (WDRO 72/1034)

WENFFORD Greeves No 779

"Lyeing by the southside of Plimm Streming into Willings takeing halfe the River with other Tynworkes called heigher and lower Wenvurr and greinewill." (WDRO 72/1034)

1. Strode acquired 1/4 part from John Bowden' of Brisworthy before 1625. (*ibid.*)

2. John Woollcombe of Shyttistor gave possession of 1/4 part to Sir Richard Strode in 1639. (WDRO 72/990)

WENVURR,HEIGHER Greeves No 782

1. Referred to in 1625; see Wenfford. (WDRO 72/1034)

WENVURR,LOWER Greeves No 783

1. Referred to in 1625; see Wenfford. (WDRO 72/1034)

2. 1/4 part of "lower Wenford" granted to Richard Stuckey in the early 17th century. (DRO 46/1/3/9))

WILLINGS; WYLLYNGES SET,GREAT; WILLINGES,GREATE Greeves No 806

1. Walter Momford gave possession of 1/8 part to John Towherman als Elliott in 1583. (WDRO 72/990/51)

2. Thomas Deane of Plympton St Marie, Tynner gave possession of 1/8 part to Philippe Strode of Shaugh, gent. in 1599. (WDRO 72/990/31)

3. Referred to in 1625; see Wenfford. (WDRO 72/1034)

WOULTERBROOK; WOLTERBROOKE [Hentor Brook] Greeves No 817

1. Referred to in 1625; see Hentorhill and Yeasterhill. (WDRO 72/1034)

YEASTERBROOKE [Spanish Lake] Greeves No 828

1. Referred to in 1625; see Yeasterhill. (WDRO 72/1034)

YEASTERHILL Greeves No 829

"Lyeing between Trowlesworthy and Hentor hill the headweare lieth att a Rocke uppon the Hill by Trolsworthy Tor bounding uppon the east side with Volterbrooke uppon the Northside with Wenford and Griddleford full to the River of Plimm and uppon the south and west sides with yeaster brooke and Foxter marishe full to the foresayd River of Plimm by the lower end of the lower hedge of Trowlesworthy wast where the tayle lyeth." (WDRO 72/1034)

1. Whole work owned by Strode in 1625. (*ibid.*)

2. John Woollcombe of Shyttistor gave possession of the whole work to Sir Richard Strode in 1639. (WDRO 72/990)